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Gold Dredging at Mammoth Bar, California

By Lewis H. Eddy*

SYNOPSIS—Pacific No. 1 dredge installed at Mammoth Bar in September, 1913, by the Pacific Gold Dredging Co. is the second bucket-elevator gold dredge to operate on middle fork of American River, Calif. It is a reconstruction of Pacific No. 1, of Oroville. The new hull was built, the machinery transported from Feather River to American River and installed, and the dredge began digging in 73 days from the delivery of the first load of lumber. This is record time for this character of dredge construction.

The Pacific Gold Dredging Co. finished Keystone-drilling a long line of gold-placer bars in the middle fork of American River, Calif., on May 27, 1913; began the reconstruction of a 7½-cu.ft. bucket-elevator dredge on July 18, and started the dredge to digging at Mammoth Bar on Sept. 30, 1913. This dredge is a reconstruction of Pacific No. 1, built and operated at Oroville. It is the second bucket-elevator gold dredge to operate in American River above Auburn. Cache Rock dredge, a 3½-cu.ft. open-link Risdon stream type, was operated for about three years and had finished its territory between Rocky Chucky Cañon and Forest Hill and was dismantled in October, 1913. The Eldorado & Placer Counties Poverty Bar dredge was launched in October and was expected to go into commission in December, 1913. This is a reconstruction of the 4-cu.ft. Risdon type dredge operated for about two years by the Beaver Gold Dredging Co. at Secret ravine south of Auburn, which finished its territory in September, 1913. The 6-cu.ft. installed at Whisky Bar in March, 1912, by the Gaylord Mining Co. is still in operation. This describes the gold dredging situation in the upper American River fields at the close of 1913.[1]

The first loads of lumber were hauled to the construction camp of Pacific No. 1 dredge on Mammoth Bar on July 17, and construction was begun on the foundation for the new hull on July 18. The hull was launched on Aug. 24 and the installation of machinery begun on Aug. 25. The hull was built 20 ft. distant from the edge of the stream, in ground that contained a large amount of diorite or diorite-schist croppings, which necessitated placing the ways above the surface of the water; and the height and distance of the hull, while on the foundation posts, from the surface of the stream, together with the narrowness of the pit, required the rigging of blocks to keep the boat from going into the water at too great speed. The foundation was of the usual construction of posts and footing blocks. When ready for launching the hull was raised by means of one 60-ton and four 40-ton jacks, worked at full capacity, lifting one side against the

Pacific No. 1 Dredge Operating on American River, Calif.

Pacific No. 1, Launched at Mammoth Bar, Calif., Aug. 24, 1913

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[1] "Eng. and Min. Journ., May 18, 1912, p. 997.

other. Three ways or skids were placed under the hull, one at the bow, one at amidship, one at the stern. Three sets of shoes were then spiked to the bottom of the hull, built of surfaced lumber a little wider than the skids, to run on the skids. Both the shoes and the skids were greased; and the boat was then lowered by the jacks, after the posts and footings had been removed, resting on a grade of 3 in. to 1 ft. The bottom of the boat after being lowered was 5 ft. higher than the surface of the stream, and the starboard, or water side, was 20 ft. away from the water. When all was ready the jacks were placed behind the boat on the port side and the boat pushed off into the water. In addition to pushing the boat into the water, it was necessary at the time to hold it from slipping too fast. The hull carried the fore-and-aft truss, cross truss, all truss rods and main gantry posts; a total weight of over 300 tons.

The new hull is 105 ft. long; 40-ft. beam; 4-ft. overhang on the port side, 3-ft. overhang on the starboard side; 8 ft. 4 in. deep. The old hull was 95 ft. long, 38 ft. 6 in. wide, 8 ft. 4 in. deep. So the old boat was 10 ft. shorter and the hull was much lighter than the new one.

The well hole of the reconstructed dredge is 6 ft. wide, the bows each 6 ft. wide at the forward ends, making a total width of 18 ft. The well hole of the old boat was 6 ft. wide, the bows were each 12 ft. wide, making a total width of 30 ft. The back of the hull where the spud works is lined with larger and heavier plate and covers a larger area than is usual on dredges where this type of lining is used. The plate is structural steel, equal to taking the kick of the dredge against the steel spud. Owing to the narrowness of the bow, which is essential in stream type of dredges, the new hull is provided with an athwartship truss across the bow to prevent the pontoons from warping. This truss is just ahead of the main housing and the winch-room housing. Some of the old boats were thus provided after years of service, but the practice is more common in the construction of newer boats. The bucket idler, which hangs in the back end of the well hole, is of different type from the Bucyrus and Yuba Construction Co. boats. It is built of structural steel; provided with manganese-steel wearing plates; and is 6 ft. in diameter.

Most of the machinery installed in Pacific No. 1 dredge had been used in the old Pacific No. 1, built by the Western Engineering & Construction Co. for the Pacific Gold Dredging Co., at Oroville. The new materials consist of a steel spud 50 ft. long, a bucket idler 6 ft. in diameter, an 8-ft. extension to the digging ladder and six additional buckets. The old boat was equipped with Bucyrus machinery and buckets of 7½-cu.ft. capacity. The digging ladder is lattice-girder type, the stacking ladder is lattice-girder type, 90 ft. long between centers, and provided with a 34-in. belt. The screens are end-shaking, 14 ft. long; the lower screen is 8 ft. 8 in. wide; the upper screen, 7 ft. 11 in. wide. One 10-in. and one 8-in. pump supply water to the screens; a 4-in. pump supplies water to the hopper.

The dredge is electrically driven by Westinghouse motors supplied with current by the Pacific Gas & Electric Co. The total power used is 250 hp., distributed as follows: Main drive, 100 hp.; winch, 20 hp.; stacker, 20 hp.; screens, 20 hp.; pumps, 50, 25 and 15 hp.

The extended digging ladder is 90 ft. long, has a digging radius of about 130 ft.; and was designed to dig 40 ft. It is equipped with 80 Bucyrus-type, two-piece close-connected buckets. About one-half of the buckets are manganese steel; the other half are cast steel with manganese insert plates to protect the back eye. The two-piece buckets are preferred by this company for reason of various economic advantages. There are not so many rivets to wear loose, and the spill is less than in the three-piece buckets. Especially in the kind of digging encountered in the American River bars the wear is chiefly on the lip of the bucket, and the breakage is less on the hood than the lip.

Both tumblers are six-sided. The upper tumbler weighs about 7 tons, and is provided with manganese-steel wearing plates; the lower tumbler weighs over 5 tons. The steel digging spud, 50 ft. long, weighs 14½ tons. A wooden stepping spud is provided, but it is not likely to be much used, as there is a scarcity of sand, and stepping ahead is done by stern lines.

The new parts were built and the old machinery overhauled in the company machine shops at Oroville, and shipped by Southern Pacific R.R. to East Auburn, where transfer was made to the Mountain Quarries R.R., operated by the Pacific Portland Cement Co., at Flint station, about five miles from Mammoth Bar. The material was then wagon-hauled by mixed mule and horse teams to the construction camp. The steel spud and the heavier section of the digging ladder each required a 16-animal team, driven with check line. The swing animals were hitched direct to the pole of the wagon; the lead animals worked on a separate chain leading to the running gear, thus providing for stepping over the lead chain by the swing and wheel teams and enabling them to pull in line with the pole at sharp bends in the road. This is common practice in heavy teaming on narrow mountain roads having short bends. It was necessary to widen and straighten parts of this road before completing the hauling of the materials as it is in many other of the mountain districts. This kind of hauling will in time be solved by medium-sized caterpillar engines.

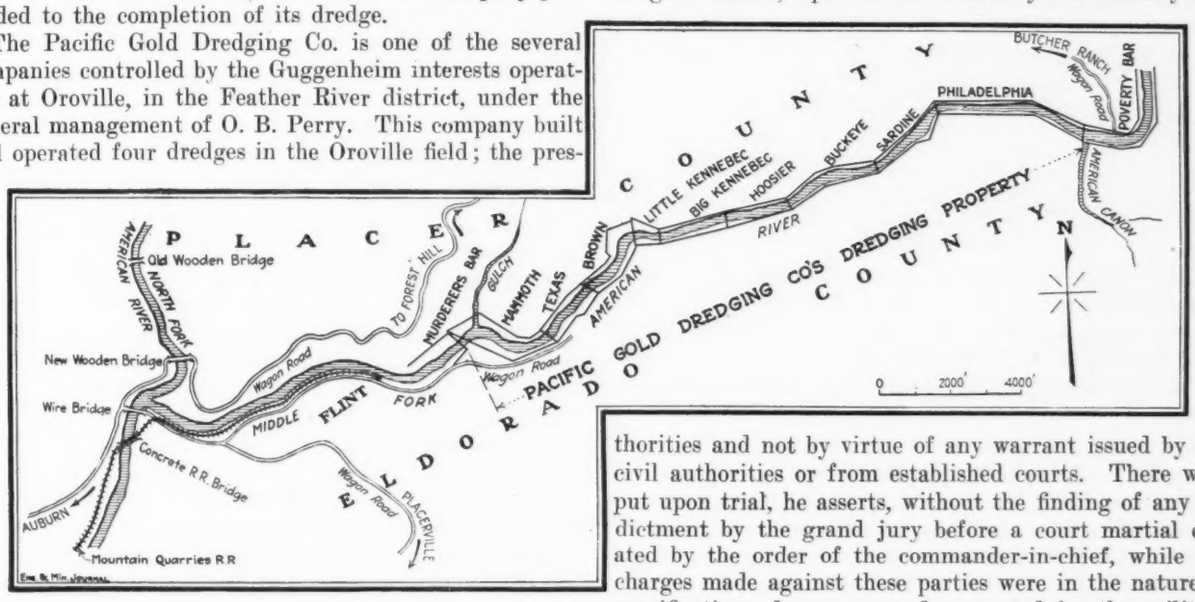
The dredging ground of the Pacific Gold Dredging Co. in American River district is situated on middle American River in Placer-Eldorado field. The property consists of nine river bars lying between Murderers Bar and Poverty Bar, having an aggregate length of 30,000 ft., and extending on both sides of the river. These bars and those to the northeast, including Poverty and Oregon Bars and the Cache Rock section, were located as placer claims in the early days of hydraulic mining on American River and yielding large returns in gold from shallow depths. The bars included in this company's holding are delineated on the accompanying sketch map in the following order going up stream: Mammoth, Texas, Browns, Little Kennebec, Big Kennebec, Hoosier, Buckeye, Sardine, Philadelphia. Mammoth Bar, the initial point of dredging, is situated four miles east and about one mile north of the town of Auburn, the county seat of Placer County. The dredging operations will extend on both sides of the river on some of the bars, following the plan of the Keystone drills in the prospecting of the ground. The dredge was constructed on the Placer County side of the river.

Eight of the nine bars were drilled with Keystone drills. Hoosier Bar was omitted, chiefly because of high water at the time of drilling in May, 1913. The river was then higher than at any other time during the season,

though it was not high as compared to other seasons. The width of the river varies at several points and reaches in some places a width of about 400 ft. The average width at low water is 75 ft. and at high water, 150 ft. Most of the bars lie on one or the other side of the river. Buckeye Bar is cut in two by the river at high water. Two drills were employed. The ground was laid off in sections 1500 ft. long. The holes were drilled 100 ft. apart, longitudinally, as the drills traveled first up-stream. On the return of the drills down-stream the spaces were filled in with additional holes, making the distances apart 50 ft.

The ground owned by the Eldorado & Placer Counties Gold Mining & Power Co., extending from and including Poverty Bar north to Oregon Bar, was also prospected by the Guggenheim interests, and an option taken on the ground and the partially constructed dredge. But the deal was not consummated, and the former company proceeded to the completion of its dredge.

The Pacific Gold Dredging Co. is one of the several companies controlled by the Guggenheim interests operating at Oroville, in the Feather River district, under the general management of O. B. Perry. This company built and operated four dredges in the Oroville field; the pres-



Dredging Ground at Mammoth Bar, Calif.

ent reconstructed dredge being the first one of the fleet. It was placed in commission on May 1, 1906, and was known originally as Perry No. 1. The company started with 750 acres of ground on the east side of Feather River, which extended over a mile inland. No. 1 dredge worked out its assignment of the territory and made a fine record. In the first 2 years 8 months the dredge turned over 64.75 acres of ground, handling an average of 117,200 cu.yd. of gravel per month, at a cost of about 4½c. per cu.yd., and digging an average of 34 ft. deep. In the full life of this dredge in the Oroville field, it worked out 176 acres, and handled 9,506,219 cu.yd. of gravel, operating a total of 7 years 2 months. The machinery which has been installed in the reconstructed dredge at Mammoth Bar is estimated to be good for four or five years, which will work out the property.

The ground included in the middle American River holding was drilled under the general supervision of F. R. Short, of San Francisco, and the direct superintendence of T. W. Mack. The dredge was reconstructed under the superintendence of H. C. Perring, who is the operating superintendent. O. C. Perry is resident manager. The home office of the company is at Oroville.

Senator Borah on the Paint Creek Strike

Washington Correspondence

Although the Congressional investigating committee charged with the duty of reporting on the conditions of the mining strike in West Virginia has not yet made ready its report for publication, Senator William E. Borah, of Idaho, has completed a statement on the subject embodying his own views which he has just made public. Senator Borah takes a strong attitude in opposition to the action of the State of West Virginia and of the coal-mine owners in that region. He finds that martial law was declared in the Paint Cabin Creek region about Sept. 2, 1912, and continued in force except at short intervals until June, 1913. During this time various individuals were arrested, tried and convicted for alleged offenses, upon orders issued by the military authorities and not by virtue of any warrant issued by the civil authorities or from established courts. There were put upon trial, he asserts, without the finding of any indictment by the grand jury before a court martial created by the order of the commander-in-chief, while the charges made against these parties were in the nature of specifications drawn up and presented by the military authorities. Continuing, Mr. Borah says: "In the trial of these parties and in the assessing of punishments, the court before which they were tried deemed itself bound alone by the orders of the commander-in-chief, the governor of the state and in no respect bound to observe the Constitution of the United States or the constitution or statutes of the State of West Virginia relative to the trial and punishment of parties charged with crime." Senator Borah further says: "At the time these arrests were made and the trials and convictions had, the civil courts were open, holding their terms as usual, disposing of cases and dispensing justice, in the usual and ordinary manner . . . . in rendering judgment and assessing punishment, the parties were punished by terms of imprisonment unknown to the statutes or in excess of the punishment provided for such offenses under the laws of the state . . . . . a number of these parties were sent to jail and many to the state penitentiary under sentence of this court martial as approved by the government. Most of those who were sent to the penitentiary were given a conditional pardon before the term for which they were sentnced had expired, the pardon being conditional in a general way upon good behavior. . . . . No threats of violence or use of force was made or had against the judges

or the courts at any time during the existence of the disturbance or the reign of martial law. . . . . Great feeling and interest doubtless prevailed generally throughout the country, but the existence of this feeling and its effect upon grand or petit juries were not tested by the calling of a grand jury, or the submitting of the charges against those persons to a grand jury, and no attempt was made to try them before a petit jury, ... the officers of the county, after the declaration of martial law proceeding upon the assumption that the feeling and prejudice were so strong as to prevent the operation of the civil authorities, together with a further belief that the declaration of martial law had the effect of suspending and nullifying all constitutional and statutory rights of the accused."

It has been expected that Senator Borah's report would be strongly critical of the mine owners and the belief is that although his report is not officially sanctioned by the committee, he being a minority member, that it will be a part of the majority's report, which, however, is expected to go considerably further in direct condemnation of the mine-owning interests than did the senator from Idaho.

Placer Gold in Panama Canal Zone

Several placer claims along the Gatun River and its tributaries, some of them within and some without the Canal Zone, have been investigated by D. F. MacDonald, the Panama Canal Commission geologist, states the *Canal Record,* with the result that nowhere was gold found in paying quantities; in most instances there was only "color." The gravels were tested by panning in the parts of the streams which seemed most likely to carry gold.

Along Guineal Creek, a smaller feeder of the Gatun River, little gravel was found, and 17 pans yielded but one small color. On Palenque Creek, 30 pans were washed, which yielded gold equal to about 2.1c. per cu.yd. On Cuatro Calles Creek, 20 pans were washed, with a yield of gold equal to about 0.7c. per cu.yd. On the Agua Clara River, the northeast branch of the Gatun River, a total of 52 pans of gravel produced gold equal to about 2c. per cubic yard.

Panning was continued down the Gatun River for a mile or more below the mouth of the Agua Clara. From 46 pans of samples selected in this locality, the yield was equal to about 1c. per cu.yd. A bar of gravel on the Gatun River, just above the mouth of the Agua Sucia, was the richest place found, and the pannings from it were kept separate on that account. At this point, six pans gave gold equal to about 7.5c. per cu.yd. The geologist was of the opinion that the gravel here could not be made to yield a profit, because the gold was exceedingly fine. A second trial made at the same bar with six pans of gravel yielded but about 1.2c. per cubic yard.

The Agua Sucia Creek is a fairly large tributary of the Gatun, and enters it about a mile below the mouth of the Agua Clara. It flows through a wide, flat tract of country, with much alluvium, relatively little gravel, and few outcrops of rock. Out of 47 pans washed along this stream, not one yielded a color. This was regarded as remarkable, because most of the streams in the Canal Zone and its vicinity show occasional colors. On the Gatun River, below the mouth of the Agua Sucia, 28 pans were washed, which gave gold equal to about 1.3c. per cubic yard.

Investigations were made also on the Quebrada Lopez, a tributary of the Quebrada Media. This creek was reached by going over the divide from Minas Bay. It flows through a deep, steep-sided valley, so that the ground at its bottom should be the result of a high degree of stream concentration. Well up toward the headwaters, five pans of gravel were washed, and these yielded gold equal to about 1.4c. per cu.yd. Some 100 yards downstream, three pans yielded gold equivalent to about 2.7c. per cu.yd. Half a mile farther down, three pans returned no colors. Two-thirds of a mile from the first washing, three pans produced gold equal to about 8c. per cu.yd. The claims along this stream are regarded as valueless.

The cost of the working varies with the amount and depth of material to be washed. The geologist is of the opinion that the particular territory tested is practically of no value for mining purposes.

Improvement in Zinc Distillation

A German patent (No. 265,327) has recently been granted to H. Specketer for an improvement on an earlier patent of his, covering the use of a rotary furnace for zinc smelting, having an intermittent source of heat, and being supplied with a stream of neutral gas to expel the vaporized zinc. The rotary furnace is particularly adaptable to zinc smelting on account of its effective mixing of the charge, and also by reason of the storage of heat from one charge to the next. The rotary furnace is eminently useful in connection with a gas producer, as a source of heat, the neutral gas then being obtained in the following manner: The gaseous products from the reduction of zinc powder and zinc oxide are periodically forced through the producer, instead of the usual air, where any oxidizing gases, such as CO_2, are destroyed; this gas is then blown through the furnace to expel the zinc vapors. This method has the further essential advantage that it is not necessary to close the connection between producer and furnace during the reduction period, since the presence of a predetermined pressure of neutral gas in the furnace completely prevents the admission of air into the reduction chamber, through either the producer or the connecting ducts.

Mines of South Dakota

Otto Ellerman, state mine inspector, gives the following statistics respecting the production of the mines of South Dakota and the number of men employed in them in the year ended Nov. 1, 1913:

Operator	Production	Tonnage	Employees
Homestake	$6,250,000.00	1,533,000	2250
Golden Reward	423,840.00	53,712	179
Wasp No. 2	286,930.00	163,380	110
Trojan	280,518.00	68,106	116
Bismarck	50,000.00*	31,980	60
Reliance	73,323.00	27,100	45
Mogul	44,117.61	5,593	20
Placer	2,000.00		15
Miscellaneous	86,371.63	10,600	165
Total	$7,497,100.32	1,893,471	2960

* Estimated.

All of these mines are in the Black Hills.

The Problem of the Prospector

By Arthur M. Swartley*

SYNOPSIS—A disquisition on the causes of present stagnation in the mining industry, on the passing of the prospector, the futility of the U. S. Geological Survey. "Scouting" by technically educated engineers and state geological surveys, organized along new lines, suggested as methods of revealing promising prospects to those who have the money to develop them.

Although the leading producers, because of increased facilities, are making our production of the metals equal to that of our best years, much has been seen of late in the technical press concerning stagnation in the mining industry. This is a question of considerable importance and of absorbing interest as well. It is the frequent topic of discussion in the mine office; in the prospector's cabin it is daily the subject for disquieting thought. What the cause and what the remedy, if any, is well worthy of our most serious attention.

The authors of these editorials and signed articles, alarmed by the stagnation in the development of the non-producers, and the failure of the prospectors to find many new camps or to make sensational strikes in old ones, have attempted to diagnose the disease and to prescribe a remedy. With many of these articles I am unable fully to agree although there is an undoubted dullness in the buying and selling of mining property, a lack of energy in the search for new districts and new prospects, while owners of the non-producers are doing but little more than the required assessment work.

Opinions Quoted

According to one of these articles[1] a principal cause is "the exhaustion of the easily discoverable, easily developed ore resources of the United States, which has greatly reduced the opportunities of the prospector and of the mining operator of small means. This is not a sudden change, but is one that has been progressive through many years. Ore discoveries were many and frequent in the '60s and '70s, fewer and less frequent in the '80s, and still more so in the '90s. Since 1891 the only new mining districts of magnitude have been Creede, Cripple Creek, Tonopah, Goldfield, Cobalt, Porcupine and the placer districts of Alaska; no great number for a period of 20 years." "The demand for good copper, lead and gold mines is no less keen. Unfortunately, it is not known where they are. We do not mean to imply that there are no more and that they will not be found, but probably they are for the most part deep-lying deposits whereof there is little or no surface indication, deposits that await deep and costly exploring before they will be found."

Statements essentially like the foregoing have been recently expressed by H. Foster Bain, Albert Burch and others. The impression conveyed by each is that new discoveries and new districts are necessary prerequisites to a revival of mining. To state the corollary: Nearly all the meritorious discoveries are being developed and the remainder have been shown to have too little merit to warrant further expenditures.

Field Men Best Judges

Possibly the great success of Burch, Bain, etc., may have militated against their complete understanding as to what is really the matter with the mining industry. Perhaps a less successful man, because of his more intimate contact with field conditions, might offer a better solution.

The successful mining geologist or engineer employed by the larger corporations is inclined to do his financial thinking in terms of six or more figures and not in that of proportionate profit. He is inclined to measure a mine with standards derived at the Bunker Hill & Sullivan, the Utah Copper, the Homestake or the Alaska Treadwell and considers anything smaller unworthy of attention. The small mine has little place in his scheme of things. He visits a district because he is sent there to value a certain property. He is not sent there unless his clients have become assured that there are likely to be orebodies sufficient to return to them net the price asked for the mine. He visits the property in question, and, if impressed, samples it, studies its immediate geology, and hastens back to his office to write his report. Thence, he goes perhaps to another quarter of the globe. The conditions of his employment are such that he does little scouting while in the district and much too often his attitude of mind, due to his associations, precludes a fair consideration of anything but proved orebodies.

The True Situation

The situation as I have observed it in several states is somewhat as follows: The prospector is not making new discoveries in old districts and few new discoveries in new territory because he thinks it is folly to open up a new prospect until an old one is sold. He sees properties with 1000 ft. or more of useful development, making what he considers a good showing and warranting vigorous continued development, go year after year without opportunity to make a sale. He observes that the owners, because of poverty or discouragement, resort whenever possible to a lease and bond to men without capital or other assets, in order to avoid expenditure for annual assessment work. These lessees in order to make beans and bacon "pick the eyes out of the mine" to make shipping ore, which upon the termination of the bond leaves it less salable than at first. The prospector is, because of these discouragements, losing faith in man though not in nature. His faith in nature is steadfast and enduring but he has been taught by experience that under present conditions there is an over production of well developed prospects—"near mines"—and until a *bona-fide* sale occurs now and then he will only half heartedly work his claims and will make but fitful efforts to find new ones.

It is manifestly absurd for any one man to decide from personal observation that there is an exhaustion of the easily discoverable orebodies in the Western states. It would take him more than 29 years to visit the 1480 mining districts of the 13 states, devoting only a week to a district. On the other hand there would be some justi-

*Mining engineer, Oregon Bureau of Mines and Geology, Corvallis, Ore.

[1]Editorial—Engineering & Mining Journal, Nov. 1, 1913.

fication for an engineer's conclusion that they are by no means exhausted, if, after rather careful scouting in many districts, he has seen in these old camps a considerable number of properties which have reached the limit of development for the owner of small means, though having little or no ore blocked out yet show the top level or two of good orebodies. Would it not be logical for him further to conclude, as I have, that in many of the hundreds of districts which he has never seen are also many others of like merit awaiting only energy, money and brains to make them successful producers?

Of course, it all comes back to the competency and credibility of the witness, and manifestly one cannot testify as to his own ability to determine the merits of undeveloped mining properties. The thing which has especially impressed me in confirmation of the correctness of my opinion is that almost every time one of these partially developed properties has been taken over by an experienced and technically educated man, the undertaking has been successful. It might almost go without saying that they are men with 10 to 15 years of broad experience in engineering and executive capacities. Such men rarely fail to determine with comparatively small expense the character of a property before the first payment upon the bonds falls due, and if they take it over they rarely fail to make it a successful producer. If there is such a considerable number of good partially developed properties, why this pronounced stagnation in their sale and development, might well be asked by the "man from Missouri." Any discussion which denies exhaustion of the easily discovered, easily developed orebodies would be incomplete and unsatisfactory without an attempt to answer this question.

Causes of Stagnation

Many have placed entirely too much emphasis upon the "wild-catter" as a factor in bringing about stagnation. He can be blamed for much but not for all. A good property in the hands of an honest but incompetent man is not only liable to lose the investor's money but will invariably do so. "Some men could not mine solid gold at a profit." A fairly competent business man with but little knowledge of mining has small chance of making a successful mine, because he nearly always lays aside those methods which have made him successful in other lines when he enters the mining field. The glamor surrounding mining, the intoxication of the game, has gotten into his blood, obscuring his better judgment. A "practical miner," although controlling sufficient funds, fails because of utter lack of business system, because of ignorance and misconceptions of metallurgical processes, and because of inability to choose the right man to solve his problems or to give the right man free rein to solve them should he by chance have secured the services of such a man. An honest man, trained technically and in the school of experience, with abundant energy and common sense, will miserably fail 999 times out of a thousand, if he has not well counted the cost. Even then he is liable to fail if he has not seen to it that sufficient money will be placed at his disposal as he shall require it, with but little interference by an outside directorate. Honesty, energy, brains and money, each and all, are required to make for success. United they stand, divided they fail.

He whose business takes him systematically to district after district is almost nightly regaled with story after story of the dishonest promoter of the boom days whose pay streak was in Pittsburgh. He sees during the day where the abortive attempts of retired preachers, granger mining companies, etc., to develop a mine have failed. He is made pensive by the sight of fairly well developed properties lying idle because a "practical man" built a jim-crow mill which lost the mineral down the creek. He is pained to note other cases where otherwise competent men have, like the man in the parable, failed to count the cost. Nearly all in the past, and many still in the present, have looked upon mining as an adventure, a chance, a lucky strike, but not as a business. Small wonder that the vast majority meet the fate of the adventurer and the "fall guy."

The publicity attendant upon the trial of Whittaker Wright and others of his ilk, the public and private disclosures of hundreds of other dishonest promoters, the activity of the Post Office Department, the many articles in the popular magazines, the enactment of "blue-sky laws" and the almost invariable failure of amateur mining campanies have all combined to drive the brass-band promoter and the itinerant peddler of mining stock from the field.

The promoters and amateur mining companies were, however, the principal purchasers of prospects, creating a ready market for any good discovery and for many that were not. This resulted in great activity in prospecting, since the demand for discoveries exceeded the supply while now the supply vastly exceeds the demand. The prospector is now left with claims on his hands too good to abandon but upon which he must perform his annual work. He has little time or money to search the hills and, besides, he is too discouraged to do so.

Although such promoters lost most of the investor's money and did much useless development, nevertheless, every year several properties passed to the list of steady producers. Now that they are out of the field there are few to take their places, so that even now they who buy nothing but mines are complaining of a scarcity.

It seems to me evident then that the stagnation in mining is not due to the exhaustion of easily discovered orebodies but to the fact that those who have in the past been the principal purchasers of prospects, have been driven from the field and justly so, while a sufficient number of buyers of the right sort have not come forward to take their place. When these arrive we need not worry about the fate of the poor old prospector. He has done his part but we are not doing ours. When we work the orebodies he has discovered, he, or they who come after him, will search for more and will find them; all this talk of exhaustion notwithstanding.

One Remedy

What then is the remedy? Who can we get to make wise selections of properties and to open them efficiently and well? The school of mines man or a man with equivalent training, well seasoned in the school of experience, in charge of development companies is the one. Men who have had 10 to 20 years of engineering and executive experience in widely separated districts are in sufficient numbers to do this work.

The managing engineers are the men who are adding more to the list of steady producers than any others. Be-

cause of the few existing development companies their number is small, yet they are steadily coming into their own. For example, northeastern Oregon, comprising several mining districts, three or four years ago had only one steady producer. The metal production was annually declining. Its early promise and the optimistic report of Waldemar Lindgren in 1900 were accompanied by great activity of the promoters. Later, the disappointed stockholders having withdrawn their support, the region settled down to small activities. Sporadic attempts from time to time were made, usually with too little capital, to carry the enterprises through. Fortunately for this region, about three years ago men of the engineering type, less than half a dozen, came here to investigate certain properties. They stayed; they had financial backing; they developed in 1911; they developed and constructed in 1912; and in 1913 they will have more than doubled the metal production of the state. There is room for others in that region and in many others of the West.

How can such development companies be financed when there is but one optimistic voice crying in the wilderness and that but a weak and obscure one? The mighty voices, at least those which have spoken, are on the pessimistic side. Publicity can do much, but what we are now having is deterrent in effect; though untrue, if persisted in, it may generally be acepted as a truism, like that of the force of dynamite being downward. If it is really true, no publicity campaign is needed. Bad news travels fast enough. If not true, the concerted efforts of engineers generally would, though helpful, improve the situation but slowly. Their reports, usually on only one mine in a district, are the property of their clients and are not often given out unless unfavorable.

The scouting engineer for a development company, by going into the field to search for a partially developed prospect, will find one in time if he has not had the misfortune to associate too long with that type of engineer who, in order to protect his reputation, makes all his reports negative. The scout goes to a prospect in a certain district in one state, and next in order may be one in a distant state. The low efficiency of this method reminds me of the reply of a prospector to my question as to how long he had prospected in that district. To this he replied: "I have been in the district 12 years but have prospected about 30 days, the rest of the time I put in cooking meals and chasing horses."

However much we may deplore the low efficiency in the methods of private organizations used in finding new properties, little in the way of improvement can be anticipated. Without an organization of trust proportions they cannot be expected to make systematic regional investigations. The prospector by reason of his isolation and educational limitations cannot be expected to make much improvement in his method of bringing his property to the attention of development companies. It is evident then that private agencies are and will be insufficient to bring about a substantial revival in mining.

Federal Survey Inefficient

Help, more effective and more efficient, can be gained through a decided change in the method pursued by public agencies, the geological surveys. In recent years the U. S. Geological Survey has become more active; in recent years stagnation has become more pronounced. Why has the Federal survey not met the needs of the mining industry? It has become entangled in a web of its own and others' weaving. It developed from a somewhat small beginning during the time when low salaries prevailed and a position with the Federal survey was a badge of distinction. It has grown to large proportions and varied labors. It serves to a large degree the various departments of the state. Its geologic work is weakened by the superficial requirements of land classification, by underground-water surveys, water-power investigations, and all of those distracting influences which are the result of the hue and cry of the conservation movement. The result is that comparatively little geological work *per se* is being done. The man of prestige leaves the service because when promoted to position of chief of a division he is tied down to an administrative desk, to the work of committees on unity and conformity, and the criticism of other men's manuscripts, so that constructive work of his own is impossible of fulfillment.

The immense area of our possessions with their varied resources so far but little covered makes many demands upon the survey unable fully to be met. The result is that we have, in the main, geologists of little reputation scurrying hither and thither, now a week or a month or two in Maine, next the same length of time in Texas or the Hawaiian Islands. Afterward, too often long afterward, they prepare from these hurried visits short papers or preliminary reports with the idea that at a later time they will return to complete their investigations, after which a final report will be written. But so many investigations are started and so few completed that we have many papers of all sorts, largely made up of a mass of undigested facts, which few read, and which are disappointing to those who have the hardihood to attempt them. Where field work is done preparatory to final reports or geologic folios the effort to economize makes the report so superficial that it is of little benefit to prospectors and developers. The geologist usually has a pronounced hobby or a pronounced weakness. He may be obsessed by the importance of stratigraphy or be weak in petrology. Because of the lack of engineering training and experience, he may go far at sea with reference to some alleged economic deposit.

But even though capable, neither the time nor the custom of the survey permits an economic bulletin to give the merits of partially developed prospects. By the time the manuscript has gone through the fiery furnace of criticism in Washington, if it had much force in the beginning, it will have lost much of its vitality. Whatever the nature of the field work or the quality of the manuscript when written and censored, the fact remains that much too long a time intervenes between the beginning of the investigation and the distribution of the reports.

Effective Survey Method Suggested

Much more effective work could be done with a few survey parties permanently assigned to a particular mining region with a reputable mining engineer in charge of the work and a chief geologist thoroughly conversant with economic geology associated with him. A sufficient number of assistant geologists thoroughly to cover the various phases of geological study and as many assistant mining engineers, metallurgists, draftsmen, samplers, assayers and miners as needed should also be in the parties. Such an organization would make full reports on pros-

pects and mines as well as sufficiently detailed information of the geology of the region. Their maps could then be upon a much larger scale permitting details of dikes, veins and smaller outcrops utterly impossible of representation upon the maps with scales now in use.

The duties of the chief geologist would be to work out the geology of the mines and more particularly the partially developed prospects and to supervise critically the work of his assistants. The work of the mining engineer and his assistants would be to conduct a thorough mine examination, especially of the partially developed prospects, which examination, in conjunction with that of the chief geologist, would enable them to advise the owner as to its future development or abandonment as well as make it possible for them to state in their reports something of its value and desirability. Progress reports should be issued at least semi-annually, in which the conclusions reached as to the new areas covered could be given.

Work of this kind, conducted and directed in person by engineers and geologists of reputation whose reports would be stripped of much useless verbiage and containing correct scientific conclusions, which are at the same time practical conclusions, would be seized upon eagerly by prospectors and investors. The field agent or scouting engineer for development companies would not be required to travel from state to state for two or three years to examine those properties called to his attention by those who had them for sale. Instead, his company, by referring to the progress and final reports of the areas already covered by the surveys, could instruct him as to the region which they wish him to visit first and the properties in that region which they desire him to examine.

This would result in much saving to the development companies already existing, and would also bring about a large increase in their number. This would result in a decided increase in the sales of partially developed prospects to development companies, with most of the latter in the hands of mining engineers of experience. The sale of these properties would free the prospector-owner from his entanglement and permit him to prospect elsewhere, while the prospector not so entangled would be encouraged, because of the sales, to make another effort.

State or National Supervision?

Whether this work could best be done under the direction of Federal or State supervision is an open question. I am inclined to think, however, that too much inertia would have to be overcome to make such a radical change in method by the Federal survey. Such a change would be easier of accomplishment by the states though by no means an easy task. At present most state surveys are but reflected images of the Federal survey due largely to the inviolable conditions imposed upon them in coöperative contracts with the Federal survey. The Oregon Bureau of Mines and Geology, of recent legislative creation, governed as it is by a technical board and directed by a geologist-engineer is apt to be the first to adopt an effective policy.

Summary

I would have you believe that stagnation is the result of ignorance and dishonesty and not because of exhaustion; that prospectors will make plenty of new discoveries when sales occur now and then of the old ones; and that there are plenty of good old ones in many western districts dormant because the usual buyers have been driven from the field. I would especially have you believe that engineers directing development companies will improve the situation best of all and quite rapidly too if the methods of conducting geological surveys are made more efficient and practical.

Canadian Mining Institute

The 16th annual meeting will be held in the city of Montreal on Wednesday, Thursday and Friday, Mar. 4, 5 and 6. The institute's headquarters will be the Windsor Hotel. Among the papers already promised for the meeting are the following: "Mill and Metallurgical Practice at the Nipissing Mining Co., Cobalt, Ont.," by James Johnston, Cobalt, Ont.; "The Sampling of Cobalt Ores," by C. St. G. Campbell, Cobalt, Ont.; "The Veins of Cobalt District," by Arthur A. Cole, Cobalt, Ont.; "Recent Improvements in Cyanidation," by Herbert A. Megraw, New York; "Some Notes on Mining and Milling Practice at the Alaska Treadwell Mine," by H. C. Meek, South Porcupine, Ont.; "Ore Dressing Improvements," by Robert H. Richards, Boston, Mass.; "Recent Metallurgical Developments," by A. Stansfield, Montreal; "Methods of Excavation in the Mount Royal Tunnel," by S. P. Brown, Montreal; "Factors Influencing the Cost of Power for Mining Purposes," by J. M. Forbes, Montreal; "High Carbon Steel for Sluice Linings in Hydraulic Mining," by Howard W. Dubois, Philadelphia; "Mining in British Columbia" (illustrated by colored lantern slides), by Howard W. Dubois, Philadelphia; "Scientific Management," by F. G. Gilbreth, New York; "Efficiency Engineering Applied to Mining, Quarries, and Industrial Plants," by H. M. Payne, New York; "The Chisana Gold Field," by D. D. Cairnes, Ottawa; "Coal Resources of the World," by D. B. Dowling, Ottawa; Asbestos Resources of the Thetford Area," by W. J. Woolsey, Thetford Mines, Quebec; "Safety in Coal Mines" (illustrated by moving pictures), by a representative of the H. C. Frick Coke Co. Pittsburgh.

Location of Mining Claims

By A. L. H. Street*

These principles of law governing the location of mining claims were recently decided by the California District Court of Appeal, in the case of Gobert vs. Butterfield, 136 *Pacific Reporter,* 516:

When a notice of the location of a mining claim is amended, to cure obvious defects in the original notice, the amended notice relates back to the time when the original notice was given, notwithstanding attempted intervening locations, but the amended notice cannot embrace new ground, nor operate to the prejudice of other persons. * * * * A location in excess of the statutory limit, where it injures no one when made, if made in good faith, is voidable only as to the excess. * * * * where the claim is once sufficiently marked on the ground, and all the necessary acts of location are performed, a right vests in the locator, which cannot be divested by the subsequent obliteration of the marks or removal of the stakes without the fault of the locator. If the evidence shows that the boundaries were originally marked, the fact that the stakes then set could not in later years be found raises no presumption against the validity of the original marking. * * * * a claim may be marked at any time prior to the acquisition of an intervening right, regardles of the question as to whether the time within which such marking was made is reasonable.

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Yamagano Gold Mine, Satsuma, Japan--II

By Taro M. Yoshida*

SYNOPSIS—Separate treatment cyanide plant is used to treat stamp-mill tailings. Sand is leached and slime is agitated with air and centrifugal pump. Zinc shavings used for precipitation. Contract miners work a portion of the mine, using their own stamp mills for crushing and amalgamation.

The sand-cyaniding plant is about 84 ft. to the west and 129 ft. to the south of the stamp mill, and 28 ft. 7 in. below it. There are four iron sand-collecting tanks, each 30 ft. in diameter and 6 ft. 4 in. in depth, with a total capacity of 110 long tons. Each tank is provided with a Butters distributor and slat gates in which 4-in. wooden slats are inserted, according to the quantity of sand in the tank, the slime being discharged by flowing over the slat gates.

Nagano Central Mill and Surroundings

Ordinarily, it requires 48 hr. to fill one of these tanks. At first the water is drained off gradually through the charge and finally a vacuum pump is used. The sand is allowed to drain for five or six days and is then shoveled out of the tank into ½-ton side-discharge cars, which run on rails over the iron leaching vats in the cyanide plant, which is situated some distance below the level of the sand-collecting room.

There are six of these leaching tanks, each 30 ft. in diameter and 7 ft. 4 in. in depth, with a capacity of 140 long tons. They have false bottoms, and water and solution pipes enter under them. It takes 8 hr. for a tank to be filled, after which the acidity of the sand is neutralized with 0.5% of lime. When the tank is full a solution of cyanide containing 0.3% KCN is applied below the false bottom in sufficient quantity entirely to cover the charge. It is then left to settle for 24 hours. The amount of solution used is about 30% of the volume of the sand. When the sand is completely saturated, the valve on the side of the vat, below the false bottom, is opened and the solution is allowed to drain for 17 hr. The discharge is finally completed by the use of a vacuum pump for three hours longer. When the cyanide solution is used for a second time, containing from 0.08 to 0.1% KCN, the proportion varies to twice the volume of the sand; this takes from 40 to 72 hr. After this treatment clear water is used, the proportion being 30% of the volume of sand; this takes 24 hr. The length of time required for the total treatment, therefore, is from 121 to 161 hr. Solution from this treatment passes through two iron launders to the gold tank in the precipitation house.

Slime Treated by Agitation

There are two iron collecting cones, one of which is 20 ft. in diameter and 20 ft. 9 in. high, and the other 20

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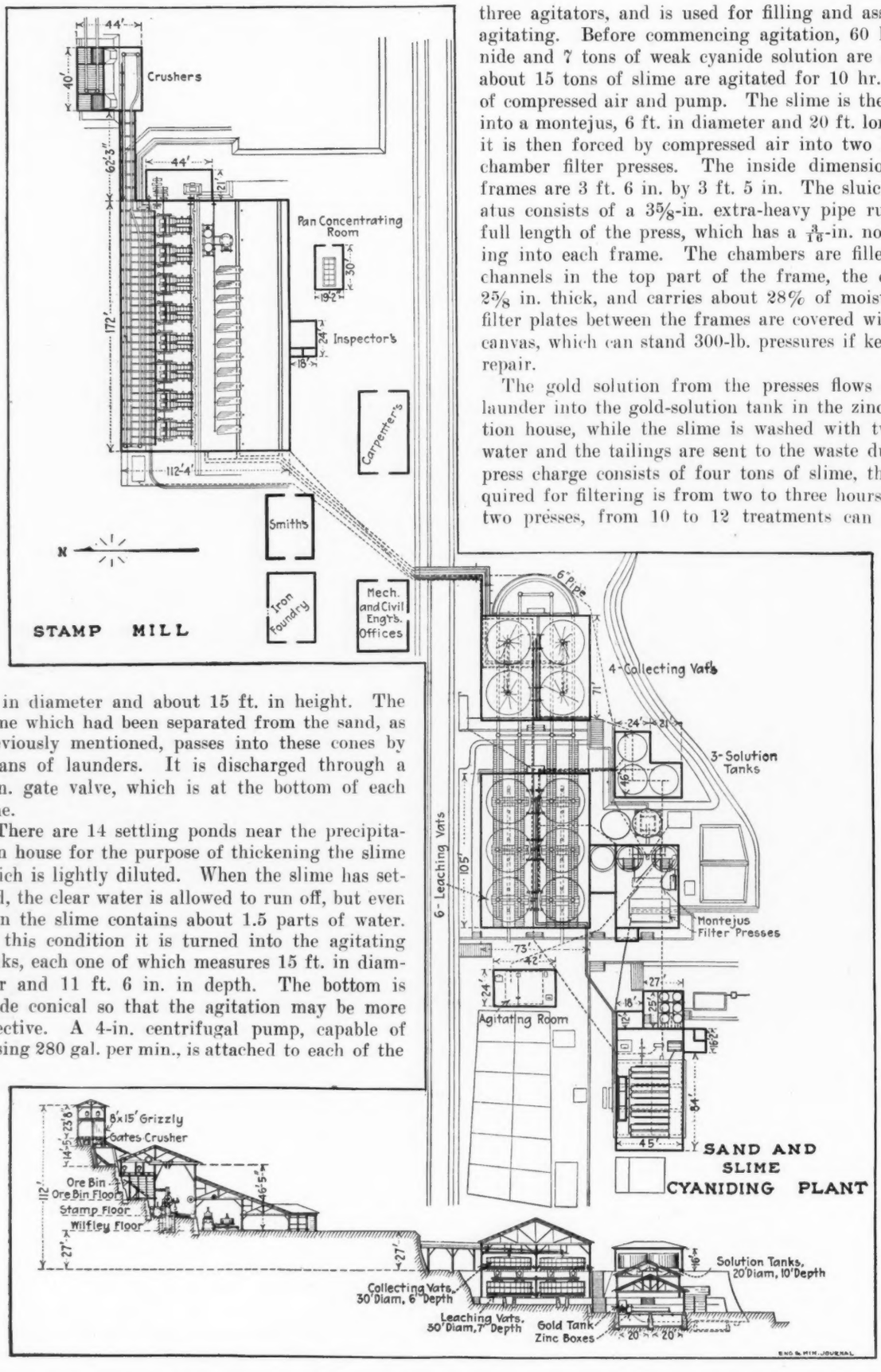
ft. in diameter and about 15 ft. in height. The slime which had been separated from the sand, as previously mentioned, passes into these cones by means of launders. It is discharged through a 5-in. gate valve, which is at the bottom of each cone.

There are 14 settling ponds near the precipitation house for the purpose of thickening the slime which is lightly diluted. When the slime has settled, the clear water is allowed to run off, but even then the slime contains about 1.5 parts of water. In this condition it is turned into the agitating tanks, each one of which measures 15 ft. in diameter and 11 ft. 6 in. in depth. The bottom is made conical so that the agitation may be more effective. A 4-in. centrifugal pump, capable of raising 280 gal. per min., is attached to each of the three agitators, and is used for filling and assisting the agitating. Before commencing agitation, 60 lb. of cyanide and 7 tons of weak cyanide solution are added and about 15 tons of slime are agitated for 10 hr. by means of compressed air and pump. The slime is then pumped into a montejus, 6 ft. in diameter and 20 ft. long, whence it is then forced by compressed air into two Dehne 50-chamber filter presses. The inside dimensions of the frames are 3 ft. 6 in. by 3 ft. 5 in. The sluicing apparatus consists of a 3⅝-in. extra-heavy pipe running the full length of the press, which has a $\frac{3}{16}$-in. nozzle pointing into each frame. The chambers are filled through channels in the top part of the frame, the cake being 2⅝ in. thick, and carries about 28% of moisture. The filter plates between the frames are covered with durable canvas, which can stand 300-lb. pressures if kept in good repair.

The gold solution from the presses flows through a launder into the gold-solution tank in the zinc-precipitation house, while the slime is washed with two tons of water and the tailings are sent to the waste dump. One press charge consists of four tons of slime, the time required for filtering is from two to three hours, and with two presses, from 10 to 12 treatments can be accom-

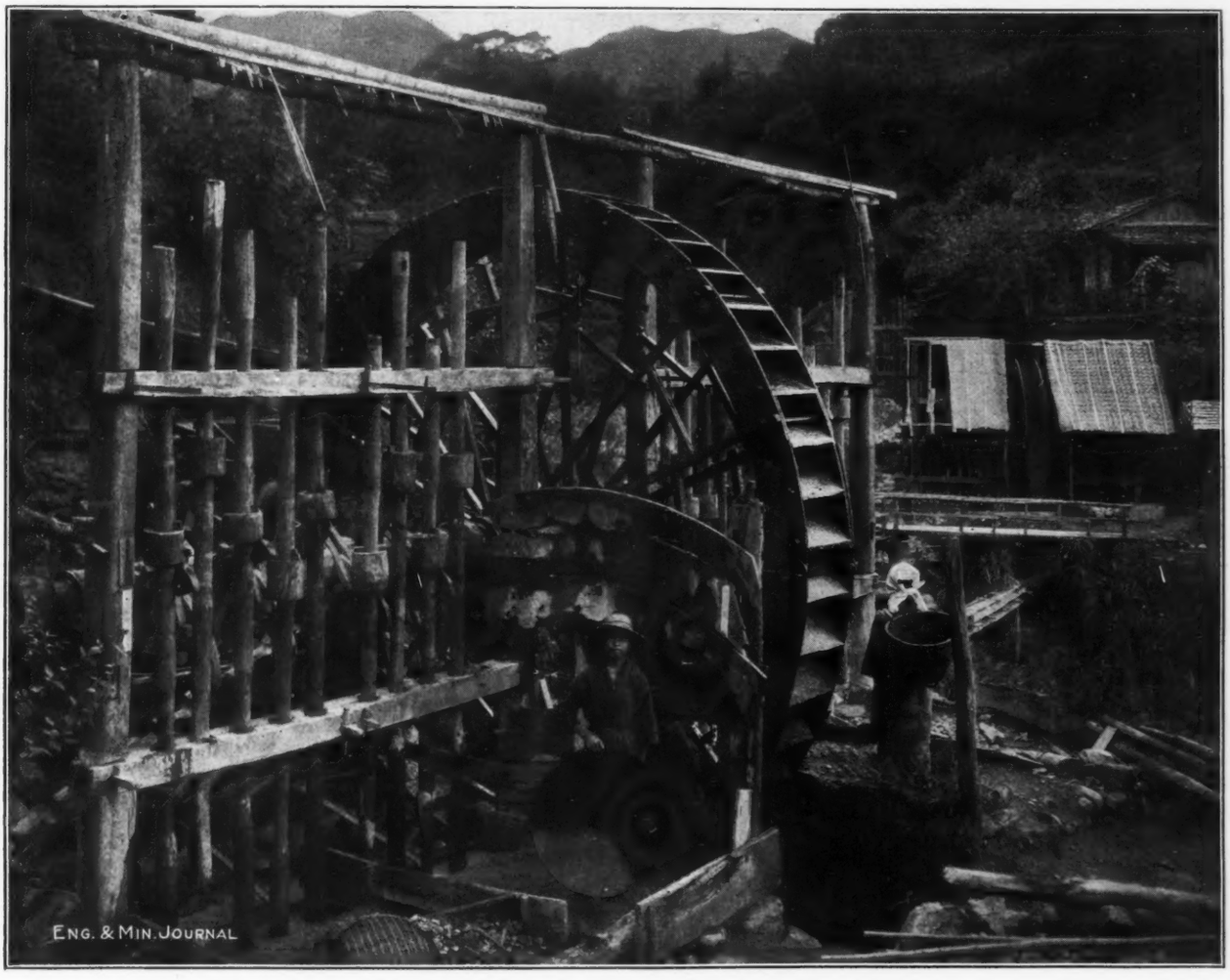


NAGANO CENTRAL METALLURGICAL WORKS, COMPRISING STAMP MILL, SAND AND SLIME CYANIDING PLANTS AND AUXILIARIES

plished in 24 hr., so that the daily capacity of this plant is from 40 to 48 tons. A 50-hp. induction motor drives the machinery of this plant.

Zinc Shavings Used for Precipitation

In the precipitation department of the mill, there is a gold-solution tank 30x5x5 ft., which is divided into two compartments for sand and slime-gold solution, and they are allowed to pass through different zinc boxes. The slimy gold solution coming directly from the filter presses is led to three sand-filter clarifiers, each of which is 6 ft. in diameter and 5 ft. in depth, and when the solution is quite clarified, it flows through the zinc boxes.



Stamp Mill Used by Contract Miners

There are eight of these boxes, each 25x3 ft. by 2 ft. 3½ in. They are divided into 14 compartments, and each box holds 700 lb. of zinc shavings. These shavings are put in the first three compartments, where they are inspected every morning with the object of replenishing those which have been consumed.

The boxes are cleaned twice a month, the shavings in each compartment being washed by shaking them briskly in the solution until the precipitate and zinc shorts are detached and fall to the bottom of the compartment. The shavings are then removed from the compartment into a wooden tank 6 ft. in diameter and 4 ft. 6 in. in depth, and diluted sulphuric acid is added to dissolve the zinc. After the dissolving is completed, hot water is poured into the vat and it is stirred well with wooden rods, and is allowed to settle for 10 hr. The clear solution is then decanted off and the tank is filled with cold water in order to wash off all the sulphuric acid in the gold slimes. This process is repeated until no trace of sulphuric acid is left. The gold slimes are transferred to a wooden vacuum-filter box and the water is drained off and is sent to the assay room. The filtered gold slime usually contains 30% moisture.

The assay office of the mill is situated about 60 ft. east of the sand-collecting house, and ore from the mines as well as samples from the mills and plants are assayed daily. All melting is also done here. Twice a month the amalgam from the stamp mills is retorted and the base bullion from the retort is smelted in a graphite crucible in a wind furnace.

When the moist gold slimes are received after precipitation, they are placed in a square cast-iron pan and are heated slowly on the furnace over a wood fire to such a temperature that one could put his hand in the pan without being burned. The slimes remain here until little moisture is left. As soon as the precipitate is dry, it is fluxed as follows: 100 parts precipitate, 60 parts borax, 34 parts bicarbonate of soda, and 16 parts powdered glass. These are all melted in a plumbago cruc-

ible. When entirely melted, the contents of the crucible are poured into a mold. As soon as the metal is set, cold water is poured on it to partly chill the slag, which is then pulled or scraped off with a hook. The bar is then turned out and plunged into cold water and scoured with wet sand. It is then rinsed off, dried, sampled by drilling ¾ in. deep on the two opposite sides, top and bottom, and is finally boxed, sacked and sent to the Imperial government mint at Osaka, where gold and silver are separated and used for currency.

Hydro-Electric Power Generated for Use in Mining

At Suitenbuchi, which is 15 miles east of the mine, a hydro-electric generating plant has been erected for lighting purposes and to operate the machinery throughout the mill, with sufficient power to spare for mining operations and the tramway. Although there is water power capable of generating 800 kw., only a 400-kw. three-phase alternating-current generator of 11,000 volts, 21 amp., and 60 cycles at 450 r.p.m., is installed at present, while the flume, power house, electric transmission lines, etc., were designed and built to allow for extensions at any time in the future. There is also a 9-kw. exciter, of 125 volts, and a Lombard governor for regulating the speed of the turbine.

There are two distributing stations, one at Yamagano and the other at Nagano. At the former station the tension is reduced to 450 volts by means of an 80-kw., oil-cooled transformer, and the current is supplied to the mill there and at Ipponsugi plant. At the Nagano transforming station, the tension is reduced to 2299 volts by means of an air-blast transformer, and then it is supplied to the Nagano region.

The blacksmith, carpenter and machine shops and also the iron foundry are completely equipped with all necessary appliances. A hospital has been provided for the accommodation of the sick and injured.

Some Parts of the Mines Worked on Contract

Besides being worked under the direction of Prince Shimadzu's Bureau of Mines, contract work is also done by miners who have obtained a concession from the bureau to exploit certain restricted portions of the mine and to treat the ore at their own primitive mills. This system of mining on lease is a peculiar feature which has proved satisfactory to both the miners and mine owners for more than two and one-half centuries. In most cases the sons have succeeded their fathers at the mine, so that there are several families whose members have been miners for nine generations.

Hydro-Electric Generating Station, at Suitenbuchi

The contract miners extract ore and convey it to their own mills by means of horses or hand carts, but most of them carry it in bamboo baskets, locally called *datsu,* on their backs. Very often women, and even young girls, help their husbands, fathers or brothers by carrying ore. The mills of these contract miners are simple and crude and generally consist of from 10 to 20 wooden stamp stems, which are worked by over-shot waterwheels. The stamps weigh about 80 lb., and shoes and dies of cast iron are used. Mercury is fed in the mortar boxes, for amalgamation. Once a day the contents of the mortar boxes are taken out and panned in a *Yuribachi* and the amalgam is caught. The amalgam thus collected is retorted every

10 days, and the base bullion from the retort is melted in a crucible. On a certain fixed date, three times a month, the bullion is brought to the bureau and is paid for according to its fineness and weight.

According to the latest investigations, there are about 150 contract miners, and they employ about 1000 helpers.

Hitachi Copper Mine Produces Most Gold

According to the annual reports of the last two years from the Imperial Government's Bureau of Mines, the property which produced the greatest amount of gold in Japan was the Hitachi copper mine of Ibaraki-keu, while the Yamagano gold mine occupied the second place. The whole amount of gold produced by the Hitachi was not really the production of that mine, but the result of smelting the ores, which it bought from several small gold mines that had no metallurgical plants of their own. Therefore, the Yamagano gold mine is actually the greatest producer of gold in the empire of Japan.

The gold and silver production of the Yamagano gold mine in the last two years, compared with the whole amount of gold and silver produced in Japan is as follows:

	1911		1912	
	Gold oz.	Silver oz.	Gold oz.	Silver oz.
Yamagano	16,389	28,290	15,688	33,082
Japan	203,804	4,497,668	217,822	4,776,596

According to the latest statistics, there are 1052 workmen employed at the mine, 865 of whom work at the mine itself, and the rest in the mills and other places. Of course, this number does not include the contract miners or their helpers.

Westinghouse Installations in Alaska, 1913

During 1913 the Westinghouse Electric & Manufacturing Co. undertook a number of contracts for hydroelectric developments in Alaska. The most important of these is the new generating unit for the Alaska Treadwell Gold Mining Co.'s Nugget Creek plant. This unit will consist of a 2350-kv.a. generator driven by a Pelton wheel running 300 r.p.m. This unit will give the mining company about 3000 hp. additional. A 50-kw. motor-generator set with special shaft, so that the unit may be water-wheel driven when desired, is also included.

A contract was recently closed for a 300-kv.a. water-wheel generator to be installed by the Chichagof Mining Co., operating near Sitka. This generator will be used to supplement the mining company's present installation of 127½ kw. With the generator in question there were also ordered the necessary step-up and step-down transformers for transmitting the energy at high voltage from the power plant to the mines.

During the summer the Kennecott Mines Co. located in the Copper River district, purchased a 300-kv.a. water-wheel generator, together with all the necessary switchboard and accessories. This water-power plant will supplement a steam-driven plant now being operated by the company, containing one 400-kv.a. generator and one 50-kw. generator. Many motors for mining and milling operations also were purchased with these generators.

In addition the Alaska Juneau Gold Mining Co. recently purchased a 1012-kv.a. generator to be driven by a Pelton wheel, the energy from which will be used to supplement that of a 937 kv.a. steam turbine.

The Importance of Fundamental Principles in Technical Education

In his commencement address at the Colorado School of Mines in May, 1913, Dr. James Douglas first drew attention to the great strides made in the copper-smelting industry since his first visit to Colorado in 1872, as exemplified particularly in the increased dimensions of reverberatory hearths, in the substitution of petroleum for coal as furnace fuel, and in the wide introduction of the bessemer converter, more recently with basic lining, in the copper industry. He alluded also to his pioneer development of the electrolytic refining of copper at Phœnixville, Ariz., paying tribute to the encouragement he received in the pursuit of this aim from Franklin Farrel and Doctor Edward Weston, of Newark. By reference to official statistics, Doctor Douglas then demonstrated that in the periodic readjustment of smelting rates, the miner had been benefited more than the smelter; thus in 1870 a miner of gold ores received only about 53% of the total value of the metallic contents, while in 1889 the percentage had risen to 83, and in more recent years to 90 per cent.

With silver ores, at the Black Hawk and Argo plants, the least payment was 54% of the total metallic value, in 1874, from which the rate had risen to 84% in 1889. Concluding his historical review, Dr. Douglas referred to the final closing of the Boston & Colorado Smelting Co.'s plant at Argo in 1910, where the old Ziervogel refining process was still competing with the electrolytic method.

Turning, then, to a discussion of his topic, Doctor Douglas said:

Looking back, therefore, on the changes in these two branches of mining and metallurgy, namely, the improvement of methods and the higher prices, which the miner receives today for the products of his industry, we are forced to recognize how, in our system of education, the study of principles should occupy a more prominent place than the study of practice. Even our acceptance of principles, outside of mathematics, should be held as open to modification, but in the main the fundamental laws of physics and chemistry may be accepted, as we interpret them, to be correct and our only safe guides. Every improvement made in Colorado has been through a better understanding of these laws, and carrying them into operation.

For instance, the effect of the injection of air into molten metal was perfectly understood before Bessemer brought mechanical ingenuity as well as chemical science to bear upon the solution of the pneumatic method. The practicability of extracting the carbon to the exact point at which pig iron is converted into steel proved to be so difficult that the Bessemer process would probably have had a limited range of usefulness had not the suggestion of another chemist been adopted, to oxidize all the carbon, then readd to the charge the specific amount of carbide of manganese with a known quantity of carbon to recarbonize the iron, while the manganese absorbed all dissolved oxide of iron. The whole success of this pro-

mentous improvement, which was no discovery at all, depended upon the application of known facts to meet certain practical conditions.

Following along the line of steel manufacture, the adoption of the basic lining in the converter, following the Thomas Gilchrist proposal to line the openhearth furnace with a basic material to eliminate phosphorus, was a simple application of known chemical facts.

Turning from the pneumatic method as applied to iron to similar methods as applied to copper, we see Holloway carrying his smelting of ore and concentration to matte up to the point at which metallic copper began to form, then the occlusion of the tuyeres in the bottom of the steel converter by the chilled copper and the loss of years in the adaptation of this simple method to the concentration of copper, till M. Manhes, adopting a type of converter with elevated tuyeres, which Mr. Bessemer had himself patented, brought the tuyeres within reach of a punching bar, and thus substantially revolutionized the metallurgy of sulphides of copper.

The wonderful progress in the study of the generation of electricity, its transmission, its conversion into power, and its electrical action, has been made within the short period we have been reviewing. It is a special branch of study and research, the intricacies of which the average student cannot thoroughly master, but with the general laws of which he should be familiar. The carrying out of any mining scheme which utilizes electricity involves the employment of an expert in the person of an electrical engineer, but if you are to be an efficient manager of a mine, mill or furnace plant you must personally know what can be done with this mighty but mysterious force, though you may leave the handling of it to your electrician.

Another element which of late we have called to our uses for service at a distance from the point of its generation is compressed air. To determine whether in each particular case, transmission by electricity or by compressed air or by a combination of both should be adopted involves on the part of the manager a fair acquaintance with the fundamental laws of electricity and pneumatics, if he is to be the controlling factor in the administration, instead of a puppet in the hands of his subordinate officers. He may not be familiar with all the practical appliances, or the latest improvements for applying these principles, but he must be sufficiently master of the subject to be the master of his staff.

There is another field which the mining and metallurgical engineer of the future will have to cultivate, and that is industrial chemistry. This is a branch of industry in which coöperation between the chemical manufacturer and the miner and metallurgist must be closer than it is at present. In fact, our metallurgical activity has been greater than the chemical, partly due to the fact that the market for chemical products has been remotely distant from the possible sources of some of the more necessary chemical ingredients. But this distance is being gradually eliminated. One of the most important iron and steel works of the country is already established at Pueblo, and there is no reason why within a limited period important chemical industries should not travel westward with the westward wave of population. Then the demand for sulphuric acid and that immensely valuable and yet noxious gas, sulphurous acid, which we are pouring into the atmosphere all over the West, will come into urgent demand. But I think that the miner and metallurgist should not wait. He should himself take the lead in developing a Western chemical industry. We are wasting the basic ingredient—sulphuric acid. You have within easy reach probably the largest deposits of phosphate of lime rock in the world. The farmer will need superphosphates and it rests with you to supply him and in doing so, develop new mining industries and recover a valuable byproduct.

In addition, Colorado possesses probably more rare minerals than you have any idea of, the recovery of which and the extraction of their precious contents will require a closer study of chemical operations than has been usually demanded of the students of mines and metallurgy. Take, for instance, your carnotite ores. The separation of the three valuable elements—radium, uranium and vanadium—should become immediately a branch of metallurgy.

In addition to the sulphurous acid which now goes to waste from furnace stacks, the waste gases from coke ovens should pave our roads with asphalt and fertilize our fields with sulphate of ammonia. It is evident, therefore, that the alliance of mining and metallurgy and the chemical industry must become in the future much closer than it has been in the past.

We are living at the close of a period of almost unnatural activity and prosperity. We have had half the new world to exploit, and, with steam and electricity as our aids, in little more than a generation we have depleted the fertility of the soil and emptied our mines of their richest ore, taking from each the stores nature had accumulated nearest the surface. The harvest has been abundant and cheaply garnered; but a future generation cannot reap crops without planting, and in our case, if mining prosperity is to be maintained, it must be by saving every product and byproduct, and widening, therefore, the field of our operations and consequently of our studies.

The experience of the past generation demonstrates how rapidly practices have changed under the application of scientific principles. The conclusion, therefore, is that, as a fundamental maxim of education, our studies should aim at a better understanding of the deep and broad laws which underlie all practice rather than the ephemeral methods of the day; and thus train our minds in habits of original research rather than obediently and servilely following the practice of the past or even of the present. The study of methods, however, cannot be neglected, but, if familiar with the principles, you are better able to use your principles in assisting you to devise methods for carrying them into practice.

The danger of too much knowledge of principles is that the scholar becomes so conscious of his shortcomings in practice, and sees so keenly the possible perfection of practice ahead, that he does not devote himself with sufficient energy to working out and practicing the imperfect, practicable methods and using tools he has to his hand to work with. Some of the cleverest men I have had to do with have developed this fault. It should be your endeavor to familiarize yourselves with the scientific basis of the subjects you have to deal with without destroying your practical ingenuity and being depressed by the evident shortcoming of your best efforts to carry principles into action.

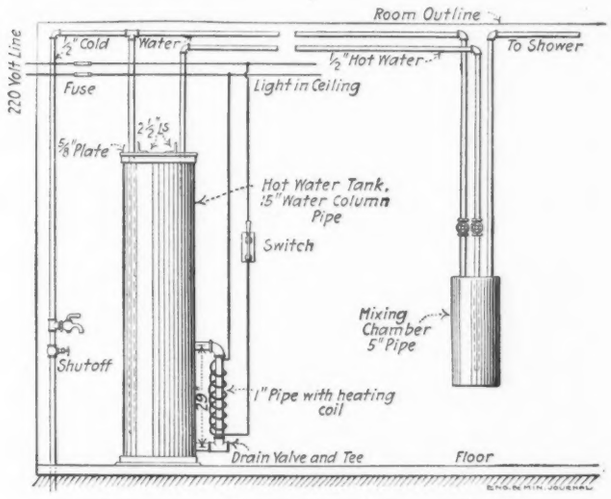
Details of Practical Mining

A Novel Shower Bath

By E. W. R. Butcher*

A novel shower bath recently constructed by the volunteer fire department of the Schley mine, at Gilbert, Minn., contains interesting features of value to anyone desiring to construct a shower bath at small cost.

The hall near which the men carried on their training was some distance from the mine, and it was not possible to use mine steam for heating the shower-bath water, consequently some other scheme had to be devised, and it was decided to use electric current.



Layout of Homemade Shower Bath

A small building, 8x14 ft., situated in back of the fire hall, had been used as a woodshed; it was cleaned out and made into the bathhouse. A hot-water tank was erected, consisting of a 6-ft. piece of old 15-in. water-column pipe. This pipe was closed at both ends with a 5/8-in. piece of plate, the upper end being braced with two 2½-in. angle irons. The arrangement of the piping is self-explanatory in the drawing. An electric heating coil surrounds a 1-in. pipe. This pipe is covered with a single layer of uncut mica, on which is wound the heating element, consisting of 25 ft. of No. 22 Calido Element wire. The vertical pipe is attached to two horizontal nipples with Navy ground-joint-union connections to provide easy access to the tank; the nipple connects to the hot-water tank.

A mixing chamber for hot and cold water is provided, consisting of a piece of 5-in. pipe, the ends of which are closed by two plates welded on. The sprinkler of the shower itself was made from a 1/16-in. copper plate. The upper part was cupped out and the lower part punched thoroughly with small holes.

Two rubbing appliances were made, a one-hand and a two-hand. The two-hand was made from 1/4-in. flexible shafting and the one-hand from 1/4-in. solid shafting. The shafting in both cases was strung its whole length outside the handles with soft-rubber washers drilled eccentric which gave an excellent kneading effect. Towels were made from cement sacks which were ripped and washed thoroughly. The men stated that they were just as good as bath towels.

*Republic Iron & Steel Co., Gilbert, Minn.

Rock Drill Repairing on Contract

From mining figures over several years for the Central Mining-Rand Mines group in the Transvaal, it appeared that the maintenance cost of machine drills worked out to approximately 175s. per 52 rock-drill machine shifts; this covered: (1) Cost of new parts and spare parts; (2) cost of hose; (3) shop costs, including white and native labor (*Journ.* So. African Inst. of Eng., November, 1913). At the Village Main Reef G. M. Co., Ltd., a system had been in use for some years of placing the drill-repair work on contract, based on a certain price per 52 machine shifts, in return for which the contractor, usually the rock-drill fitter, was responsible for the purchase of spare parts, keeping drills in order, preventing waste of material, etc.

The cost of keeping the drills in order was here so much lower than the average, that the system was carefully investigated and a model form of contract was drawn up for the other mines. The contract system was then put into operation gradually on several of the other mines, with results most satisfactory, as will be seen from the table. The costs fell in about 20 months from 176s. to 113s. per 52 machine shifts, a saving of 36%. The system was slightly modified in one or two cases to suit different conditions on other mines, but generally is worked as follows:

The rock-drill fitter is given a certain price for 52 rock-drill machine shifts to keep the machine drills in good condition, and at the end of each month he has on the credit side of his balance sheet a certain sum, which represents the total number of rock-drill machine shifts returned by the mine multiplied by the contract price, and on the debit side is the cost of spare parts of labor, etc. The contractor can make what arrangements he likes for the repair of the drills. From the amount left by deducting the debit side from the credit side, the guaranteed wage paid to the contractor is taken, and of the balance so obtained, one-half is taken by the mine and the other half by the contractor. In this way the mine shares with the contractor any savings which may accrue through increased skill in workmanship and care as to waste, etc., and if the price is properly fixed to start with, which, of course, is the essense of the contract system, the contractor can go ahead with his work without fear of having his price cut. It is to the contractor's interest to see that no waste of spare parts, replaced parts, etc., takes place; the savings accruing are marked.

A clause in the contract calls for the drills to be

brought up from underground after each one has worked for 156 shifts, and when taken to the shops they have to be carefully overhauled and put into working order practically to correspond with a new drill. The pistons have to be ground and the cylinders reamed; standard reamers have been supplied for all various sizes to which a cylinder can be bored, usually in steps of $\frac{1}{32}$-in. diameter. It will thus be seen that by starting with small cylinders and large pistons, as the large pistons are ground down, so the small cylinders are reamed to certain increased diameters, and there are always standard pistons to fit standard cylinders.

This question of reaming cylinders and grinding pistons to an agreed fit is of much more importance than was at first thought, as air leakages increase rapidly with increased wear on the drill. Although the cost of reboring and refitting pistons would be increased the more frequently the drill is taken into the shops, yet the saving in air and the increase in drilling speed would probably more than pay for the slightly increased cost in maintenance.

AVERAGE COSTS OF ROCK-DRILL MACHINE MAINTENANCE

Month 1911	Total Rock Drill Machine Shifts	Total Cost in £	Cost per 52 Shifts in Shillings
Jan. to Dec.	746,485	126,622	176
1912			
January	75,019	12,865	178
February	72,022	11,505	166
March	72,617	10,275	147
April	69,224	9,758	147
May	73,909	10,111	142
June	71,166	10,738	157
July	75,998	9,635	130
August	73,516	9,110	130
September	71,023	8,759	128
October	75,287	9,083	127
November	75,396	9,238	127
December	72,176	8,827	127
Totals and average for 1912	877,353	119,904	142
1913			
January	79,202	9,139	120
February	70,579	8,263	122
March	72,780	8,542	122
April	77,665	9,042	122
May	80,983	9,540	123
June	75,890	8,917	122
July	66,322	8,117	127
August	75,864	8,255	113

The main advantages of the contract system for repairing drills are threefold: (1) It stops waste of spare parts and connections; (2) it stops waste of air by systematically reconditioning drills and preventing the great air leakages which existed when drills were allowed to run on indefinitely; (3) it has called attention to defects in the stores system and the handling of machines.

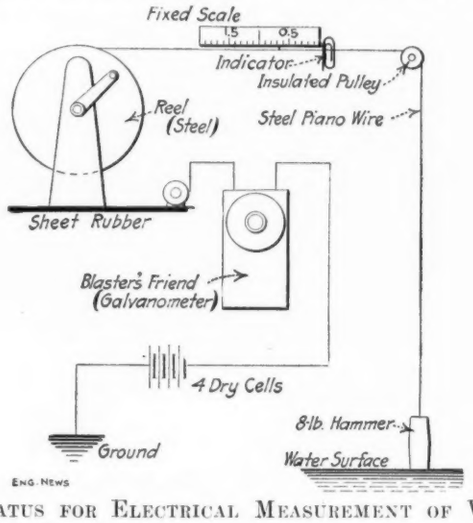
Included in the contract is the cost of drill hose and here again a considerable saving has been effected by preventing waste. For instance, on one mine the hose costs were, for the first half-year, 4.5s. per machine shift, and for the second half-year, when hoses were included in the contract price, the cost dropped to 2.5d. In some cases a hose cost as high as 1s. per machine shift, was dropped in four months to 1.5d. per shift. The figure of 2d. to 3d. per shift is a fair standard to which hose costs should be worked. One of the first criticisms likely to be made is that, if hose costs are brought down too low, there is the tendency to have faulty hoses in use on the mine, with the result that the consumption of air will increase, but it was found that the mines with the lowest hose costs were in nearly all cases the lowest in air consumption per machine shift.

Taking the cost of maintenance of rock drills per 52 shifts, and excluding hose, it will be found that the proportions of the cost borne by the various items going to make up the total are approximately: Spare parts, 60%; white labor, 25%; colored labor, 7%; sundries, 8%; the spare parts are the biggest item to be watched, and economies are particularly made by preventing their waste.

A fair average standard of cost should be about 90s. to 95s. per 52 rock-drill machine shifts, including hose; if this figure can be obtained in practice, there will, in most cases, be a considerable saving effected over the old system.

Electrical Measurement of Shaft Water Level

A method for measuring the position and the rate of change of the water level in certain shafts of the Catskill aqueduct, consists in lowering a steel wire to contact with the water, thereby completing an electrical circuit; (*Engineering News,* Dec. 25, 1913). A steel reel is used to wind a suitable length of steel piano wire graduated in 50-ft. units, and is insulated by dry wood, a sheet of glass or rubber. An 8-lb. hammer is suspended endwise from the bottom of the wire to straighten the kinks and to give a good contact with the water. The wire is graduated while under stress of this weight, the graduation being marked on ellipsoidal pieces of solder molded on the wire. The reel is grounded through a galvanometer and four dry cells; the cells are encased in a box with a galvanometer on its top so that



APPARATUS FOR ELECTRICAL MEASUREMENT OF WATER LEVEL AND RATE OF CHANGE IN SHAFTS

the whole can be quickly set up in connection with the reel.

In making an observation to determine the rate at which water is rising, the reel is set a convenient distance away from the shaft and the wire carried over an insulated pulley, so as to give a horizontal stretch of wire along which a scale can be fixed for rate measurements. The wire is lowered until the galvanometer indicates that the weight is in contact with the water. By raising and lowering the wire and observing the galvanometer, the weight is set a trifle above the water. A paper clip is fastened on the vertical part of the wire at a known elevation and another on the horizontal part over a noted position on the scale. The time at which the rising water reaches the bottom of the weight in this position, is noted. The weight is raised immediately a certain distance, measured by the movement of the second marker

over the scale, and the time of a second contact is observed. The elevation of the water surface is readily obtained by taping from the first marker set to the nearest 50-ft. graduation. This may be done after a series of rate measurements have been made so that all the elevations will be known from a single taping and the observed distances on the scale.

The method is similarly applicable to a falling water surface. Its advantage over a float or sounding bell is its great accuracy, since the time only need be observed at the instant of measurement; the distance for a rate determination can be set at leisure during the period of rise or fall and the elevation can be determined at any time.

Mine Water Launder and Inverted Siphon

Most of the Cuyuna mines are extremely wet and the glacial drift which forms the overburden is so porous as to be in effect a great filter. Any shaft is likely to have to drain a large area of surrounding country and the water after being pumped to the surface, must be carried a long distance to prevent its returning to the shaft. For this purpose launders are used and a portion of such a one built by the Barrows mine is shown in the accompanying illustration. This is 3600 ft. long, with a grade of ½ of 1%. It is 20 in. wide by 16 in. high inside and is designed to handle 5000 gal. of water per min., although at present only 2000 gal. is being pumped. The trestle on which it is carried is built largely of round timber, braced with lumber in the manner shown. The height of the trestle varies with the ground, in order to preserve grade; at the shaft it is 25 ft.; the end bent on the left in the picture is 16 ft. and that on the right is 12 ft.

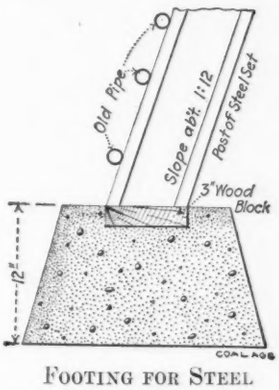
INVERTED SIPHON OF 20-IN. PIPE TO CARRY MINE WATER UNDER RAILROAD TRACKS

The inverted siphon shown is necessary for passing the water under a railroad track. It is built for the most part of spiral-riveted pipe 20 in. in diameter. The inclined sections lie at an angle of 45° and two 45° elbows are used to make joint with the horizontal section under the track; two steel boxes also are required to join the pipes to the launder and make the bends at those points.

The Haber & Leiser firedamp whistle is the subject of a recent paper by Mr. Beyling, engineer in charge of the testing station at Derne, Westphalia, in "Glückauf." Although he is on the whole favorably impressed, he believes that the experiments have not yet sufficed as a basis for unqualified indorsement.

Bearing Block for Post of Steel Set

One mining company using steel timber sets builds concrete bases for its posts but, in order not to render the support too unyielding (*Coal Age,* Dec. 13, 1913), a wood block 3 in. thick is placed in the top of the concrete pedestal as illustrated. When the weight comes on this wood filler it is often crushed till but 1 in. through. This takes up those changes in the relative elevation of back and bottom, which often occur. The lagging over and alongside the timber sets is usually of scrap pipe and when enough of this material is obtainable, it is purchased elsewhere. Of course, this pipe lagging is supplemented in various ways by cross-lagging of rock or wood. The pressure is not sufficient to crush the pipe.



FOOTING FOR STEEL POST IN MINE SET

The Globe Drop Shaft

BY WILLIAM J. SMITHAM*

Dropping a timber shaft is always expensive; just how expensive, depends on the depth of overburden and what it consists of. Various combinations of sand, gravel, boulders and clay are possible, of which the worst in my experience is clay mixed with sand and boulders. When I was sinking the Globe shaft in the copper country we penetrated 160 ft. of sand and boulders before reaching a 40-ft. bed of clay. Passing through the sand, the boulders accumulated and followed along down so that we had a choice collection when we reached the clay, some weighing as much as six or eight tons. Some of the large ones, crowded between the clay and the shaft sides, became a serious menace. A big boulder takes the total pressure corresponding to its cross-section and concentrates this almost to a point. Evidently, this would break almost any timber. The most effective way of releasing this strain I found was drilling auger holes through the timber near the part where the boulder bore, connecting the hose to the pump and putting a 1-in. pipe on the end. With this, the clay could be softened and sluiced and the boulder allowed to pull away slightly from the shaft. Sometimes I have drilled holes into the boulder itself and blasted them, but this is risky work and not always effective.

When we had reached the clay and still had 75 ft. more to go, the management got skeptical as to the possibility of reaching the ledge by the drop-shaft method and decided to try an experiment with Interlock sheet piling. Against my will I had to make arrangements to try this material. This necessitated cutting out several dividers, which was a most dangerous proceeding, since the 26-ft. wall plates under heavy pressure needed the bracing afforded by the dividers. In addition to this, a 40-ft. guide exactly plumb for the piling and another 20-ft. guide for the hammer had to be constructed. This prepara-

*Captain, the Tully mine, Iron River, Mich.

tory work took three weeks, and was extremely expensive. The pile was equipped with a water jet at the bottom to disintegrate the clay. The hammer was handled with a small hoist on the top of the shaft, and with a 20-ft. drop delivered a 20-ton blow. Three days' hammering on one pile got it down 14 ft., where it stuck. This was the end of sinking with steel piling.

Following this failure, the management decided to make a shoe of this piling and force it down with hydraulic jacks inside the shaft. We got this shoe down 35 ft., but inasmuch as it was as flexible as an old-country chain harrow, 35 ft. was the limit; alcohol for the jacks got to be an expensive item, furthermore, without considering its effect on the workmen.

Resort was then had again to the drop shaft, and after straightening things around, I started it dropping again, more slowly, but nevertheless, surely. The timber and bolts of the shoe had to be chiseled out, a far from pleasant job, but at last we had dropped the shaft to the bottom of the inner shoe. The management then proposed another scheme, but this time I successfully discouraged the idea and was allowed to continue in my own way. We finally landed in the ledge at 235 ft. from the surface.

The water flow was 500 gal. per min., the shaft was 16x26 ft. outside, built of 16x16-in. Washington fir. The whole job took a year and seven months, including that wasted in experimenting. The depth of 235 ft. is the greatest on record for a timber drop shaft.

The shaft was finally sunk to a depth of 960 ft., the lode crosscut and explored on four levels without finding enough copper to make a boat nail. The property was therefore abandoned.

Underground First-Aid Stations

Examples of some underground first-aid stations installed in the mines of the Northwestern Improvement Co., operating in Montana and Washington, are shown in the illustrations (*Coal Age*, Nov. 22, 1913). Fig. 1 shows the details of the first-aid box; Figs. 2 and 3 show typical installations. In Fig. 2, a wooden stopping is shown, used to carry the box on one side of the door. The box is mounted in a wooden frame and illuminated by five 32-cp. lamps. The wooden frame is 2 ft. 6 in. long, 2 ft. wide, and 6 in. deep, made of inch boards and lined with an asbestos back. The bottom of the frame forms a shelf on which may be placed any supplemental articles, such as bottles of picric acid. The timber and the walls are all whitewashed. No man in the mine can fail to know where to go in case of emergency, and there is always sufficient light by which to work.

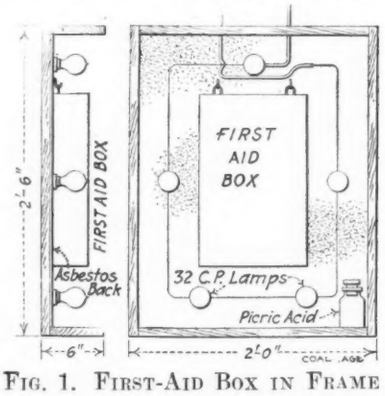


FIG. 1. FIRST-AID BOX IN FRAME

Another manner of installation is shown in Fig. 3. This is a station cut in the rock, about 12 ft. long and 6 ft. high, lined with wood and whitewashed. In addition to the first-aid box, a roll of blankets in a closed sheet-metal tube or frame, 5 ft. long and 10 in. in diameter,

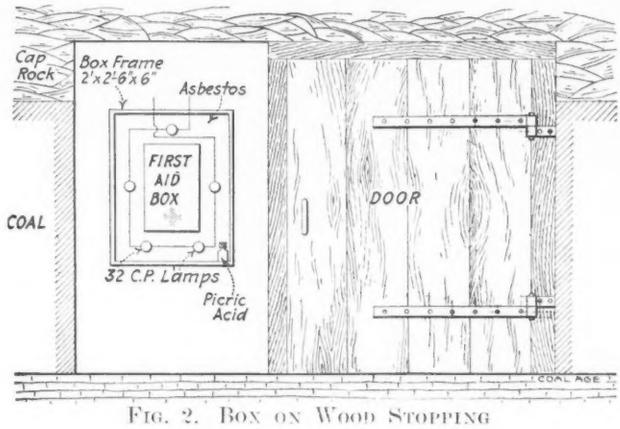


FIG. 2. BOX ON WOOD STOPPING

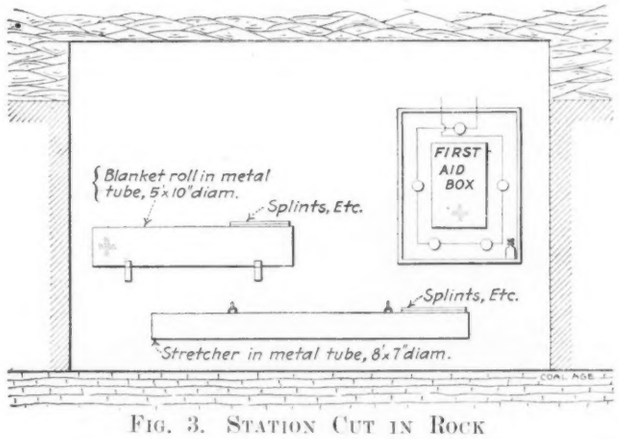


FIG. 3. STATION CUT IN ROCK

is suspended on a pair of hangers. A stretcher in a metal tube, 8 ft. long and 7 in. in diameter, is similarly supported. These metal tubes are of either galvanized or ordinary iron, painted black and marked with a large red cross. A complete assortment of splints rests on the tubes.

Saving in Air Consumption

The advisability of paying close attention to the air consumption of the machine drills in a mine, especially where power is purchased, is shown by the experience during 1912 of the Central Mining-Rand Mines group on the Transvaal (Journ. So. African Inst. of Eng., November, 1913). During this time, a thorough study of the subject was made and the new methods of handling the machines adopted. The air consumption for all purposes underground was reduced to units of 3¼-in.-piston drill shifts. The average number of such units was between 75,000 and 80,000 per month over the year. The air was purchased in so called air units, representing energy to the extent of 0.641 kilowatt-hours. The consumption of these units was about 11,500,000 per month and the average consumption per machine shift was reduced from 163 to 138. This represents a clean saving of $0.25 per machine shift, over $225,000 in a year's time. This would seem worth while.

Details of Metallurgical Practice

Dewatering Feed for Hardinge Mill

By Donald F. Irvin*

Prior to the installation of an 8-ft. Hardinge mill at the Tigre mill, plans were made for its pulp supply to be drawn from a Richards vortex classifier, which was to handle the discharge from 20 stamps. Battery screens were originally 20-mesh, but afterward were made up from four-mesh screen, both in Rek-Tang and square-aperture plain wire. The rock crushed is moderately hard, carrying 40% to 50% quartz, the balance forming a clay-slime upon crushing.

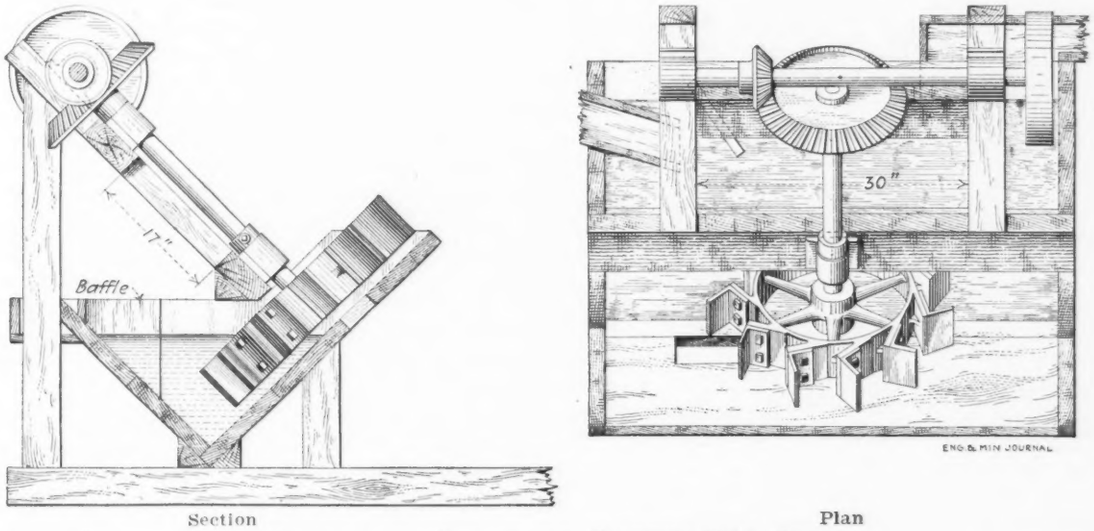
A shorter period of operation pointed to the need for a cleaner separation of the quartz and clay than could be had by the use of the Richards vortex classifier alone, and a pulp with less moisture for the feed to the Hardinge mill. Governed somewhat by existing structural conditions, a mechanical dewaterer and roughing classifier was improvised and installed between the vortex classifier and the Hardinge mill to effect the desired changes in the pulp.

This machine is a dewatering paddle-wheel, and as such was formerly used to dewater the feed to rolls in the old concentrator of the Tigre Milling Co., S. A., before the construction of the present stamp-mill. The type used is the variation of the original Fleming dewatering paddle-wheel as made in Cananea by David Cole for use in the concentrators of the Cananea Consolidated Copper Co. On pages 1590-91 of Richard's "Ore Dressing," Vol. 3, is a description of the original Fleming machine to which the improved Cole type is superior, through the use of small replaceable paddles of iron plate, bolted to the central cast-iron spider. These paddles wear well, are easily made by the blacksmith when needed, and the whole machine is much cheaper and more serviceable than any of the common classifiers used for the same purpose.

In operation, pulp is admitted at the rear of the paddle-wheel into the hopper, within which the wheel revolves at 8 r.p.m. The heavy, coarse grains of sand sink at once and are scraped up by the paddles, the moisture draining away while the paddle and its load are rising from the level of the pulp in the hopper to the sand-discharge slot. Meanwhile, the finer material flows through and past the paddle-wheel, and out over the discharge overflow at the opposite end of the hopper.

A desirable feature of this machine is that the feed entrance and the exist for both classes of products made by it are all at approximately the same level, which is an especial advantage when remodeling a plant with little or no fall available for added equipment. The moving parts are light and the shaft boxes are above the level of the pulp, preventing any bearing troubles.

This machine is now handling 125 to 135 lb. of dry pulp per minute with a minimum of attention. It is driven by a 3-in. two-ply belt, and the power requirement is small. Space needed for installing it may be altered somewhat in accordance with individual ideas of proper shape and size of hopper, but will not vary greatly from that given in the accompanying sketch, which will approximate 42 in. long, 52 in. wide, and 54 in. high over all. Only 30 in. of the total height is above the level of the scoop feed on the Hardinge mill, while the pulp feed entering hopper is about 2 in. lower than sand-discharge outlet. Range of adjustments is limited to speed of shaft, inclination of the wheel, and moisture ratio of the incoming pulp.



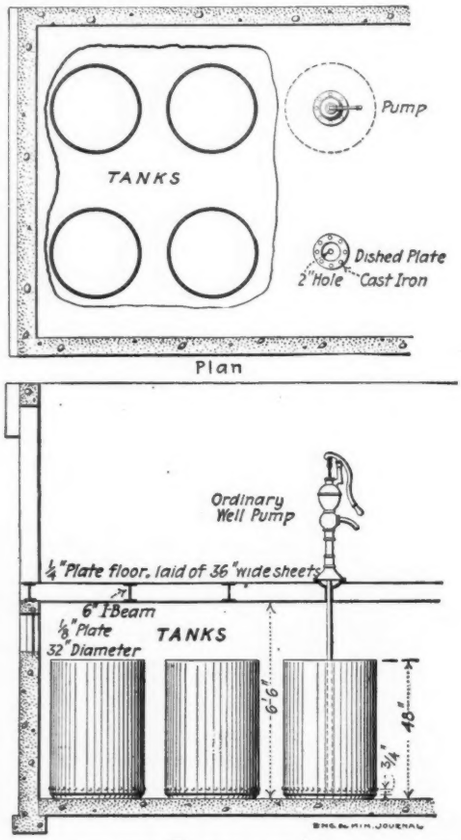
Section Plan

Machine for Dewatering Hardinge-Mill Feed

*Tigre Mining Co., Esqueda, Sonora, Mexico.

Efficient and Economical Oil House

Economy in the use of lubricating oils is one of the essentials at a well managed mine and a suitable building for its storage should be provided. The accompanying sketches show a type of oil house often seen at the mines of the Lake Superior district.



ARRANGEMENT OF THE TANKS AND PUMPS IN THE HOUSE

There is no chance for oils to be wasted while filling the cans for delivery to the mine or power house. No spigot can be left open and oil allowed to run to waste. The tanks are filled from barrels emptying in the dished plates in the floor. The noninflammable construction of the building is noteworthy. The drawing shows an ordinary well pump applied to the purpose; in many cases pumps made for the purpose are used, which are sometimes automatically measuring.

Precipitation of Copper from Mine Water

After inspecting the precipitating launders at Butte, J. W. Richards suggests (*Bull.* A. I. M. E., Nov., 1913, p. 2701) that more rapid precipitation would be secured if the scrap iron were allowed to lie on copper sheets laid in the bottom of the troughs. By the present arrangement, as soon as a piece of iron acquires a coating of copper, the subsequent allotropism becomes more and more retarded; but if the iron were put into contact with copper, the local electricity thus produced would cause the cement to be precipitated on the copper sheets, leaving the iron practically clean and chemically active.

Magnetite Linings for Basic Converters

Archer E. Wheeler and Milo W. Krejci read, before the Butte meeting of the American Institute of Mining Engineers, an illuminating paper on the development of the Great Falls converter practice. This has been supplemented by a paper in the December *Bulletin* on the subject of "Monolithic Magnetite Linings for Basic Copper Converters," referring to the "process of forming furnace linings" described in their U. S. pat. 1,068,470, of July 29, 1913. It has been the aim of many metallurgists to coat the interior of their converters with protective magnetite, and the successful control of the thickness of this coating has been the determining factor in the tonnage of copper treated by basic converters. The noteworthy success obtained at Great Falls makes of special interest the detailed description, by Messrs. Wheeler and Krejci, of their method of applying this lining to the converters:

The newly lined shell is heated up gradually to a bright red heat and charged with liquid matte; preferably of low grade, say 35%. The charge of matte is blown for 10 or 15 min., when the addition of cooling materials will be found necessary on account of the increase in temperature in the converter. The cooling is performed by the addition of cold matte. Alternate blowing and the addition of cold matte is continued until the charge is blown to white metal. No ore or other siliceous material is added in the blowing of the initial charge of matte, and, therefore, with the lack of silica the conditions have been right for the formation of magnetite.

The interior of the converter has now become coated with the magnetite formed during the blow. A fresh charge of liquid matte is added, together with a little less than the requisite amount of silica, and blowing is continued in the regular way until the brick lining is thoroughly coated and no brick is exposed. After this the actual silica required to flux the iron is used. In the blowing of the matte without ore the iron becomes oxidized to Fe_3O_4, and the sulphur to SO_2. The working temperature of the converter can be kept down to normal by adding cold matte, converter cleaning, scrap, or ore, the material used depending on the operating conditions of the charge. Should the coating become too thick, the silica of the charge can be increased as well as the temperature, and a portion of the coating removed; and *vice versa* in case the coating wears off and the brick becomes exposed.

The melting point of magnetite is given by various authorities as from 1527° to 1538° C., whereas the ordinary working temperature of the converter will rarely exceed 1200° C., unless improperly operated.

In the patent above cited, the claims are broad and do not restrict the application of the protecting layers to a basic lining, nor is the protective coating limited to iron oxide. Messrs. Wheeler and Krejci state it as their belief that the great duty obtained for linings by the basic-lined converters at Great Falls is due primarily to the monolithic magnetite linings, properly handled. They also express the belief that it will be possible to use a cheaper original lining than magnesite, and have made some experiments along that line, though at the time of writing these were not conclusive.

The Assayer and Chemist

Analysis of the Platinum Group

[In a recent number of the JOURNAL (Dec. 20, 1913,) we printed a number of articles on the determination of the platinum metals. Below we append some excerpts on the same subject by the "Journal" of the Society of Chemical Industry from *Zeit. anal. Chem.*, p. 740, 1913, and a paper from the Journal of the Chemical, Metallurgical and Mining Society of South Africa.

If explanation be necessary for devoting so much space to this subject, we believe that it is justified by the lack of material of this class on which the commercial assayer can work, and by the increased interest in the platinum metals, with the corresponding call on the chemist for such determinations.—EDITOR.]

The method is a modification of that of Deville and Debray (*Ann. Chim, Phys.*, 1859, p. 439). The ore (3 grams), from which grains of gold may have been separated mechanically, is decomposed by *aqua regia,* the residue of sand, osmiridium, etc., weighed and fused with borax and metallic silver, the silver button treated with nitric acid, and the insoluble osmiridium weighed. The acid solution of the ore, after expulsion of nitric acid, is treated with chlorine, evaporated at a low temperature, the residue treated with water, the solution saturated cold with ammonium chloride, the precipitated double ammonium salts of platinum and iridium ignited, and the metals weighed. The mixed platinum and iridium are treated with *aqua regia,* the solution again saturated with ammonium chloride, and the ignited precipitate redissolved, in order to separate platinum from any iridium still present. The ammonium chloride filtrate is precipitated, boiling, with dimethylglyoxime ("Journ." Soc. Chem. Ind., p. 960, 1913), and, after ignition, the gold obtained is dissolved in *aqua regia,* any platinum precipitated from the solution with ammonium chloride, and the gold, after removal of ammonium chloride, precipitated with ammonium oxalate and weighed as metal.

Palladium is determined in the filtrate, nearly neutralized by ammonia, by adding dimethylglyoxime and the filtrate from this reduced by zinc and hydrochloric acid. The reduced metals are treated with dilute nitric acid (1:1), the insoluble portion fused with potassium bisulphate, and the melt of rhodium sulphate dissolved in strong hydrochloric acid, small quantities of iridium and platinum remaining insoluble. Rhodium is precipitated from the solution by reduction with zinc. The nitric acid filtrate, after repeated evaporation with hydrochloric acid, is used for the determination of copper by thiocyanate, and the filtrate from this is treated for the recovery of small quantities of rhodium by reduction. Iron is determined in the filtrate from the first zinc treatment by oxidizing, precipitating as basic acetate, dissolving in hydrochloric acid, reprecipitating as basic acetate, and finally weighing as oxide.

Palladium is quantitatively precipitated by α-nitroso-β-naphthol on boiling and may be determined in the presence of (ferric) iron and copper as follows: The chloride solution (containing not more than 0.05 gram of palladium) is diluted to about 150 c.c., 20 c.c. of concentrated hydrochloric acid and 20 c.c. of acetic acid are added, the mixture heated to boiling, and a hot saturated solution of nitroso-β-naphthol in 50% acetic acid gradually introduced, as long as a red coloration (giving place to a red voluminous precipitate) is produced. The mixture is filtered hot, and the precipitate washed with hot 5% hydrochloric acid, followed by hot water, dried, ignited and reduced in hydrogen. Copper is determined in the filtrate by precipitation as thiocyanate and iron in the filtrate from the copper by oxidation with nitric acid and addition of ammonia, the precipitate being dissolved in hydrochloric acid and precipitation repeated. The method is accurate but offers no advantages over separation with dimethylglyoxime; in the latter method, the filtrate, after separating copper, may be boiled with a large excess of nitric acid and the iron precipitated directly with ammonia.

Assay for Gold and Iridium in Black Sand

During this investigation, 20 experiments were conducted, each including from three to six duplicate determinations, which had for their objects the following: (1) To ascertain a simple and rapid method for the absolute recovery of all the gold contained in solution in aqua regia. (2) A research on the operations of flattening, rolling, annealing and parting silver-gold buttons. (3) To ascertain the most efficient methods of fluxing and treating black sand, for the maximum recovery of both gold and iridium. (4) To ascertain the best method for separating and estimating gold and iridium, when obtained together after parting from silver. (5) Examination for the presence of platinum.

As a result of the above tests, the following plan was formulated for general application to material of this character. In it are embodied all the fine points brought out by the several investigations.

Cover three roasting dishes with a layer of fine silica, or washed slime residue, and on each spread out one assay ton of the black sand. Roast at a scarcely perceptible red heat in the muffle till sulphur free. Flux as follows:

Black sand	1 a.t
Soda carbonate	2 a.t
Borax	1½ a.t
Litharge	1½ a.t
Flour	4 gm.
Silver	q.s.

The black sand, of course, is weighed before roasting.

Mix thoroughly in a mortar. Transfer to a paper bag, and roll into a very compact parcel, which will fit well into the crucible. Have crucible in the fire, and when at a good read heat, place bags in crucible, closing off draft for a minute till fusion has taken place, then

Note—Excerpts from a prize paper by Christopher Toombs, in a competition organized by the Witwatersrand Coöperative Smelting Works, Ltd., and published in the "Journ. Chem., Met. and Min. Soc. of So. Africa," July, 1913, p. 4.

opening the draft and finishing at a nearly white heat. Wash with a mixture of litharge and flour, pour and cupel. With the series cupel one or two pieces of pure gold, with the necessary silver. Remove beads from cupels, clean off any adhering cupel matter, flatten and anneal; roll and anneal. Part in porcelain crucibles, using dilute nitric acid (5 HNO_3 to 12-H_2O). Bring the acid to the boil, and cool to about 80° C., before throwing in the cornet.

The action should be brisk but not vigorous, so as to keep the iridium adhering to the gold. Put on hot plate and heat to about boiling, without any actual ebullition; decant off acid, wash and anneal. Mr. Toombs strongly advises annealing over a bunsen burner as there is a tendency for the iridium to stick to the porcelain crucible if heated too strongly. Weigh gold and iridium together; dissolve out gold with 1 c.c. 10% aqua regia in a long test tube. Filter off the iridium, wash, dry and ignite over a bunsen burner (not in muffle), weigh, make a deduction for filter ash, the remainder being iridium. Subtract this from the sum of gold and iridium; this gives the weight of fine gold in the 1 a.t. fused. Weigh the parted pure gold checks and make an addition or subtraction as the case may be.

In the writer's opinion the foregoing is all that is necessary to obtain very accurate gold and iridium results.

The practice of roasting and adding excess of flour has been selected as giving good gold results, with a maximum value for iridium over any of the other methods tried, and it is most essential that the assayers employed by the mines (the sellers) should use the same method (roasting, fluxing, etc.) as the assayer at the smelting works, otherwise an iridium result of anything from a trace up to 2 oz. may be obtained.

If it is desired actually to recover and weigh the gold separately, the precipitation by cuprous chloride from an alkaline cyanide solution will be found to give maximum results in a minimum time.

Fill a quart bottle about one-third with copper-sulphate crystals, fill up with strong hydrochloric acid and shake occasionally till the copper sulphate is dissolved. Place about eight or 10 pieces of stout copper wire almost the length of the bottle, inside. In about four or five days the solution becomes almost colorless, and is then in a cuprous state, a good test for its condition being to let one drop fall into a beaker of water when a milkiness should be produced.

Determination of Oxygen in Brass

The determination of oxygen in copper is conveniently made by igniting the metal in hydrogen, and either determining the loss suffered by the filings, or by weighing the water formed. (For the most refined methods for this determination see p. 1179, ENG. AND MIN. JOURN., June 15, 1912.) This method is inadmissible with brass, as the zinc distills over, invalidating any differential weighings of the metal, while the water formed cannot be weighed, since in the cooler portions of the apparatus the reducing action is reversed and we have $Zn + H_2O = ZnO + H_2$.

T. West (*Trans.*, Inst. Metals, August, 1913) proposes that this oxygen which exists chiefly as zinc oxide, be determined by reduction with CO and weighing the CO_2 formed. Carbon monoxide was prepared by heating sodium formate with sulphuric acid.

$$HCOONa + H_2SO_4 = HNaSO_4 + H_2O + CO.$$

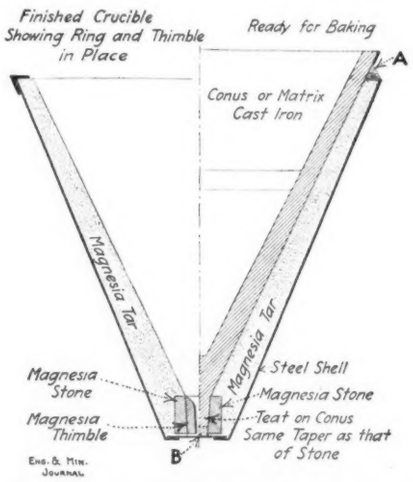
The CO, after collection in an airtight gasometer, was purified by passing through a solution of caustic potash, then solid pieces of caustic potash to remove CO_2, then a heated Jena glass tube with copper gauze to remove the last traces of oxygen by burning it to CO_2, then again through a solution of caustic potash, then through strong sulphuric acid, again through a Jena tube with copper gauze to remove the last traces of oxygen, then again through caustic potash, and again through strong sulphuric acid.

The carbon monoxide must be passed in a rapid stream; the metal to be reduced should be held at 1050° C. for an hour and a half, and about 30 grams of the metal to be tested should be used, or otherwise the difference in the weights of the absorption bulbs before and after the reduction differ by amounts within the experimental error of the method. Ordinary brasses of good quality contain an average of about 0.002 to 0.003% oxygen.

Magnesite Crucibles

BY FREDERICK COHEN

I have read with interest the article in the JOURNAL of Sept. 13, 1913, in regard to magnesite crucibles. It may be of interest to know that for some time the Gold-



MAGNESITE CRUCIBLE FOR THERMIT

schmidt Thermit Co. has been using magnesite for the lining of its crucibles for the same reasons as noted in your article, namely: (1) That it stands the great temperature produced by the ignition of thermit, and (2) because it is inert to the thermit.

We, however, use our magnesia combined with tar as a binder and have had no unsatisfactory results. The linings of our crucibles made this way have outlasted any other scheme that we have been able to devise. We make these crucibles in this style from ones having a capacity of 4 lb. of thermit to ones having a capacity of 400 lb. and we make even smaller crucibles for special purposes. The accompanying illustration gives a general idea of how we make our crucibles.

The London Bullion Market

SYNOPSIS—Abstract of Pixley's & Abell's annual review.

The chief features of the London market in 1913 were the continued demand for gold from all the European financial centers, when it was needed to make up the losses and disturbances resulting from the Balkan wars; and the continuation and final collapse of the great Indian silver speculation. The following details are abstracted from the yearly report of Messrs. Pixley & Abell, of London.

Gold

Throughout the year the price of bar gold has been quoted at 77s. 9d. per ounce standard, and, with the exception of Germany and Russia, the Bank of England has not had any active competition from foreign countries for the consignments of bar gold arriving in London week by week, but there have been occasions when it seemed possible that New York might secure some large portion of the arrivals. However, only £600,000 has gone to that quarter.

On two occasions only has an alteration been made in the Bank discount rate during 1913. From Jan. 1 to Apr. 17, it stood at 5%, on which date the rate was lowered to 4½%, which held until Oct. 2, since which date 5% has been quoted. The average rate is 4.769% for the year.

The imports of gold into Great Britain for the year were as follows:

	1912	1913		
	Total	Bars	Coin	Total
West Africa	£1,473,000	£1,596,000	.....	£1,596,000
Java	494,000	336,000	.....	830,000
Brazil	549,000	472,000	3,412,000	3,884,000
South Africa	41,234,000	40,798,000	.....	40,798,000
British India	4,217,000	2,345,000	454,000	2,799,000
Australia	511,000	452,000	.....	452,000
Egypt	.....	.....	1,748,000	1,748,000
Argentina	.....	.....	3,551,000	3,551,000
Holland	3,000	.....	445,000	445,000
France	80,000	.....	934,000	934,000

The notable feature of the year was in the large importations from Brazil and Argentina, which exceeded by £2,624,000 the exports to those countries.

The exports of gold from London for the year were as follows:

	1912	1913		
	Total	Bars	Coin	Total
Russia	£400,000	£2,080,000	.....	£2,080,000
Germany	2,669,000	8,824,000	.....	8,824,000
Holland	1,033,000	96,000	.....	96,000
France	1,617,000	1,831,000	£4,042,000	5,873,000
Switzerland	730,000	442,000	.....	442,000
Turkey	3,161,000	401,000	450,000	851,000
United States	1,904,000	600,000	.....	600,000
India	13,105,000	9,955,000	940,000	10,895,000
Egypt	8,330,000	.....	7,775,000	7,775,000
Brazil	3,929,000	.....	1,071,000	1,071,000
Argentina	1,795,000	.....	1,700,000	1,700,000
Central America	.....	.....	1,739,000	1,739,000

The features of the year were the large takings of Germany, France and Russia and the decreased exports to India.

For the 10 months ended Oct. 31, the imports of gold into India were as follows:

From	1912	1913	Changes
Great Britain	£10,759,000	£9,792,000	D. £967,000
Australia	9,001,000	1,073,000	D. 7,928,000
Egypt	6,222,000	5,638,000	D. 584,000
Total	£25,982,000	£16,503,000	D. £9,479,000

The chief part of the shipments into India in 1913 was in small bars, the proportion of sovereigns being much less than in the previous year. The decrease in imports in 1913 was chiefly from Australia.

Silver

To those who follow the course of the silver market there has been much of interest in the history of the past year. Among the most important events may be mentioned the successful issue of the £25,000,000 loan to China; the suspension of the Indian Specie Bank, with the collapse of the native group of speculators, who have influenced the market for so long, and further important purchases of silver by the Indian government. In addition there has been political unrest both in Mexico, the largest producer of silver in the world after the United States, and also in China, the only important country which still maintains a silver currency, and which, in consequence, is one of the largest users of the metal. As a result, the market has been an irregular one and difficult to forecast.

The highest quotation for the year was 29.375d. on Jan. 7 and 8; the lowest, 25.9375d. on Dec. 1; the range being 3.4375d. The average was 27.576d. for the year.

India, with its immense population, has again been the dominating factor in the market. Its government has purchased during the year about £5,500,000 of silver for coinage into rupees. Of this amount, £1,000,000 was bought and shipped in January, making, with £6,000,000 bought in 1912, £7,000,000 to meet the demand for rupees during the export season of 1912-13, while the excellent crops of this year have necessitated further purchases of about £4,500,000 during the autumn months. These later purchases have all reached India and are now being coined, and should yield a little over 10 crores of rupees. According to the last return from India, the total holdings of rupees and of silver available for coinage are about 24 crores.

The up-country demand for silver improved, the total offtake at Bombay being about 41,000,000 oz. in 1913, against 28,700,000 in 1912, and 47,500,000 oz. in 1911. The stocks at Bombay were decreased by about 11,000,000 oz. during the past year.

Though India has been favored with a succession of good harvests during recent years, and the well-being of its people must in consequence have been greatly improved, it is disappointing to have to record a serious financial crisis during the closing months of the year. A succession of failures among the native banks due to reckless trading and to speculation in various commodities on an unwarranted scale, at length culminated in the closing of its doors on the Nov. 29 by the Indian Specie Bank, the most important of these institutions. It then became known that, besides other speculative transactions, it was committed as a bull to about £3,000,000 of silver on this market, an amount far larger than had been suspected. For a few days prices fluctuated wildly, but on Dec. 4 a strong syndicate was formed in London to take over the whole of this silver, and so prevent the panic, which would certainly have occurred had this silver been forced upon the market. The fact that the market has maintained a steady tone since Dec. 4 seems to show the wisdom of this action. The return of confidence has been assisted by the knowledge that other Indian speculators

had bear accounts open, which, at the time of the failure, were estimated at nearly £2,000,000, and by the very moderate offerings from America, due to the reduced output of the Mexican mines. With the liquidation of these large speculative accounts, which have had an undue influence for some years yast, it is hoped that the market will shortly be placed on a sound and normal footing.

A Royal Commission has been sitting in London since the summer to inquire into the whole question of Indian finance, and its report, which is expected to be issued during January, is awaited with great interest. Though no change in the Indian currency system is to be anticipated, it is possible that the commission may make important recommendations as to the amount of silver that shall be held, and as to the composition of the gold standard reserve.

China has been fairly quiet during the past year, and it would seem that the country is gradually settling down under the new régime, though there are still signs of unrest beneath the surface. Yuan Shi Kai has been formally elected president of the new republic, but it still remains to be seen how far he can successfully carry his policy. After much opposition the long expected loan for £25,000,000 was successfully issued, in May last, by a five-power group of bankers, representing Great Britain, France, Germany, Russia and Japan, the United States having withdrawn from the negotiations earlier in the year. The effect on the silver market of this loan has not been apparent, quotations for some weeks after the issue having steadily declined. No progress has been made during the past year with the proposed currency reform. Stocks of sycee and bar silver in Shanghai again show a large increase, and now amount to £5,785,000. It is understood that a large part of this stock is silver sent in from the interior of China for safe custody by native banks and others and cannot be offered for sale.

In Germany a bill passed the Reichstag in March providing for an addition to the imperial war chest of 120,000,000 marks in gold and also of a similar amount in silver. About 75,000,000 marks (£3,750,000) in gold has since been added to this fund, making with the amount already held £9,750,000. We understand that no purchases of silver have yet been made, but a little over £2,225,000 of bullion will be required.

The total imports into the United Kingdom in 1913 were £14,520,000, of which £13,260,000 were from the United States, Canada and Mexico. The exports from San Francisco to China were £2,348,000. Exports from Great Britain show some interesting changes, as below:

To	1912	1913	Changes
China	£1,909,950	£827,000	D. £1,082,950
India	12,390,641	9,850,000	D. 2,540,641
Russia	975,530	735,000	D. 240,530
Germany	938,922	1,900,000	I. 961,078
France	362,320	550,000	I. 187,680
Holland	257,000	385,000	I. 128,000
West Africa	490,952	600,000	I. 109,048

The total exports from the United Kingdom were about £15,326,000 during 1913, against £18,333,019 the previous year. The following figures give the stocks of silver, sycee, etc., held in Bombay (by the Bazaar), Shanghai and London:

	1911	1912	1913
Bombay	£1,584,000	£1,740,000	£162,000
Shanghai (exclusive of dollars)	3,230,000	3,347,000	5,785,000
London	1,900,000	2,000,000	1,900,000
On the water for India and China	298,000	2,100,000	140,000
Total	£7,012,000	£9,187,000	£7,987,000

The Mexican situation was affected by the decrease in production and by the retention at home of silver needed for coinage, to supply circulation.

Why Mining at Joplin Does Not Languish

JOPLIN CORRESPONDENCE

Significant of what adversity sometimes means to individuals as well as to industries is the remarkable development of the local mining industry in the face of the worst price conditions that have prevailed for zinc ore for several years. It is no exaggeration to say that for six years no such number of new prospects has been opened up and such a volume of small tonnages offered as have been noted in the Joplin, Mo., district during the last two months. It is production, too, that comes mostly from labor with the very minimum of investment of capital.

MINERS BECOME MINE OWNERS BY LOSING THEIR JOBS

When the sheet-ground mines of the Webb City-Carterville district began to shut down last autumn and to throw men out of employment, and when mine after mine was forced to cut the prevailing wage scale or close, many men were forced to look out for a livelihood from some other source than hunting a mere job. Naturally these hordes of men being miners, turned to what they were familiar with, and they sought leases upon lands that had a reputation for shallow ores where it was not difficult to sink a shaft and where past experience showed the probabilities of finding ores were rather large. Some sought shallow-lead fields, others the zinc-silicate diggings, while still others the soft-ground blende deposits. All three classes have shown a remarkable activity that has puzzled many people unfamiliar with Joplin conditions. For instance, many have wondered how it was possible for the lead-ore output of 1913 to break all records in the face of a half year of actual hard conditions in the Joplin district with blende ores, the staple product, showing a marked decline. It was equally remarkable that calamine ores showed so large a tonnage in the face of the blende decline. Many also wondered why certain camps of the districts lost so heavily while others actually showed an almost unbelievable increase in output. The answer is in the small prospector and producer who was forced to enter the productive field when he lost his job as a day laborer in the large mines.

SMALL OPERATORS ATTACK DRAINAGE PROBLEM

Concrete instances of new developments of this character will suffice to show the trend of present mining conditions in Joplin and how idle capital is at last waking up to what this new condition of activity among the miners and prospectors means and how it may help and profit by it. Perhaps the most notable single instance of this character is that of Schoenherr and Cogswell, who have just incorporated a company known as the Lone Elm Mining & Development Co. that has taken under lease 240 acres of the Granby Mining & Smelting Co.'s land and 80 acres of the Picher Lead Co.'s land lying immediately north of Joplin, embracing a large part of what was among the earliest mining areas in the entire Joplin field. Idle for years, because of the heavy drainage problem involved, this large acreage of land which has been

productive of several thousand tons, both of lead and of zinc ores, has laid right at Joplin's back door awaiting someone with backbone enough to get out the water, when it would yield its output just as of old. Despite the water conditions confronting them a number of small operators have continued work on the surface gouges and shallower workings and have been profitable producers of zinc-silicate and lead dry-bone ores. These have had to confine their operations entirely to the hill areas.

The new lessee is now installing two large pumping stations to attack the water problem. That it is a serious water problem is admitted, but the goal is just as desirable in contrast. It means that practically the whole of the old early-day Joplin camp with its multiplicity of mine workings and drifts which have been long filled with water will have to be pumped dry for the whole underground drainage is known to go out through Lone Elm Hollow and through Joplin Creek, which converge north of Joplin at Turkey Creek. Practically the whole of North and East Joplin has been the scene of heavy mining operations and previous attempts, made many years ago, developed the fact that pumping would have to be heavy and continuous over a long period to accomplish results. This experience is being profitably made use of by the present lessees through the introduction of larger pumps and the best machinery obtainable for that purpose, together with the fact that they are prepared to keep up operations over at least two years to accomplish their ends. Even though it takes a long period to drain the tract to the 200-ft. level, ore production becomes possible as soon as the water level goes below 30 ft. and production will, therefore, begin almost immediately in the vicinity of the pumping stations, for it will not take long for that level to be reached with the proposed equipment.

Stimulus to Leasing Felt by Old-Time Miners

Quick to realize from this new proposition, the older miners and prospectors, who have been in the field long enough to remember the halcyon days when lead and zinc was taken out of these tracts in large quantities at shallow depths and at small cost, are seeking leases and preparing to begin operations the moment the pumps make any impression on the water. As a preliminary to this the Lone Elm Mining & Development Co. has let a contract for subdividing the tract into 200-ft. mining lots, which will be leased to all who care to undertake to work them. The moment that surveyors started to work the ground was daily visited by scores of the old miners who were again looking up their old shafts and "diggings" and seeing if they could again secure a lease upon them. Present indications point to one of the greatest revivals of shallow mining operations that have ever been developed in the district and immediately upon the very site of the earliest worked ground.

Silicate Camps Open Southeast of Joplin

Southeast of Joplin lies an area known for years as a zinc-silicate camp. There, too, operations have been of a desultory character during the long period of good wages paid in the large sheet-ground mines which attracted the miners away from the prospecting work that is always necessary to the development of such mines. Lately there has been a returning to the old fields and a camp of no mean proportions now exists. About 15 shafts are again being operated, some of them old ones while others are new, but all are more or less productive of a high-grade silicate ore. Found at depths of 20 to 90 ft. the cost of mining is low, especially when the operators themselves do from all to at least half the work themselves. Besides the ore when taken out sometimes needs no cleaning whatever beyond hand picking or washing over a grizzly and at most one-fourth to two-thirds of the product hand jigged. With such operations the cost of production is low enough that miners can make much better money for themselves at $16 to $25 per ton of concentrate than they could at the highest rate of wages paid in the field. Besides it is money that is better spent when it is made by actual production instead of drawn as wages. In addition, the small outlay for starting such operations is almost negligible and is within the reach of most any group of four to eight men. It often consists of no more than a hand windlass, a barrel sawed in two for tubs, a rope, a few strong boards, a few picks and shovels and enterprise enough to rig up and dig a hole to the ore. In most cases it is possible still to get enough small timber around the ground to crib up the shafts and provide sufficient timbering to hold the ground long enough to accomplish the work of getting the ore from the lease or until it is cheaper to sink another shaft anyway. When a turn-in is made, then it becomes possible to provide steam boilers, hoist, etc., if the prospect seems to warrant it.

Depression Makes for Better Citizens

It is a singular coincidence that the type of citizenship in the Joplin district is actually bettered by such a period of depression as it has been passing through. Those miners with no other ambition than a job have sought other camps or other fields for their endeavors, leaving only those men with grit enough to undertake actual mining. Men with grit of that kind appear to spend their money more judiciously and saloons and such amusement places have suffered a great deterioration in their business. One hears less on the streets on Saturday nights, "Going up to the Two Bills' Saloon" or "So and So's Place," etc. It is more often, "Well, how's yer diggin's?" "Struck stuff yet?" "Got her big, this week." "Made a killin'." "Best silicate I've ever seen." "Nothin' doin' yet, but the ground is the best lookin' lead ground you ever saw," etc. It is a better atmosphere to be in. More full of the kindly human traits of interest in the work of each other. Everyone while losing his job has acquired some lease or prospect and this interest, purely personal, is actually being impressed on a whole community that numbers between 150,000 and 200,000. Mining while prosaic, full of details, and often unpleasant and full of arduous labor has a psychology as regards individuals and communities that offers some substantial food for thought.

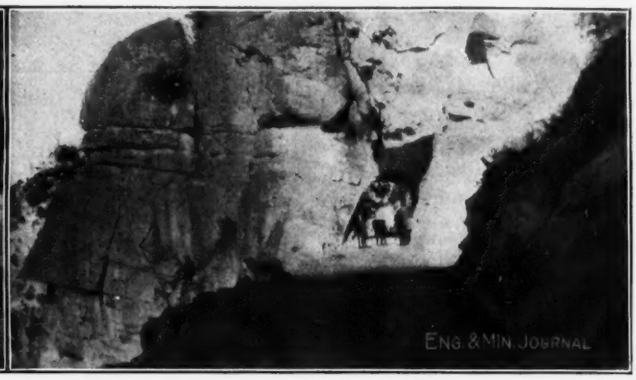
Use of Crude Oil in United States

It is estimated that more than 32,000,000 bbl. of crude oil were used by railroads of the United States for fuel in 1912, according to *Engineering and Contracting*, Dec. 31, 1913. This was an increase of more than 4,000,000 bbl. over 1911. During the last few years, crude oil has replaced coal for fuel on the locomotives upon many of the railroads in Texas, Oklahoma and Louisiana.

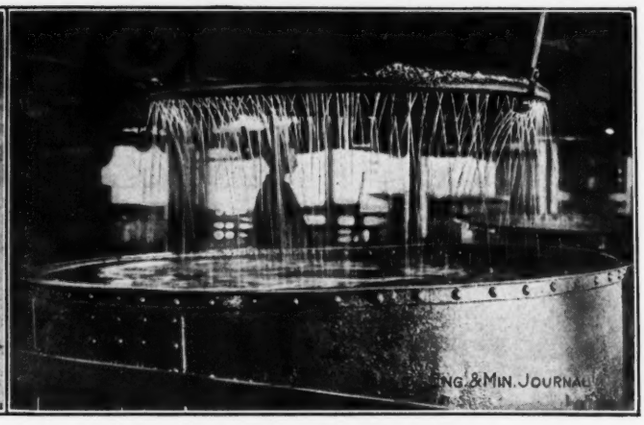
The total mileage of railroads now operated with fuel oil is about 28,000 miles. More than 1200 oil-burning locomotives are in use on the Southern Pacific and more than 800 on the Santa Fé.

Photographs from the Field

DRILLING CONTEST, OCAMPO, CHIHUAHUA, MEXICO



WAGON ROAD BETWEEN OCAMPO AND TEMOSACHIC



BREAKING DOWN CRUDE SALTS AND DISSOLVING TANK OF A GERMAN POTASH MINE

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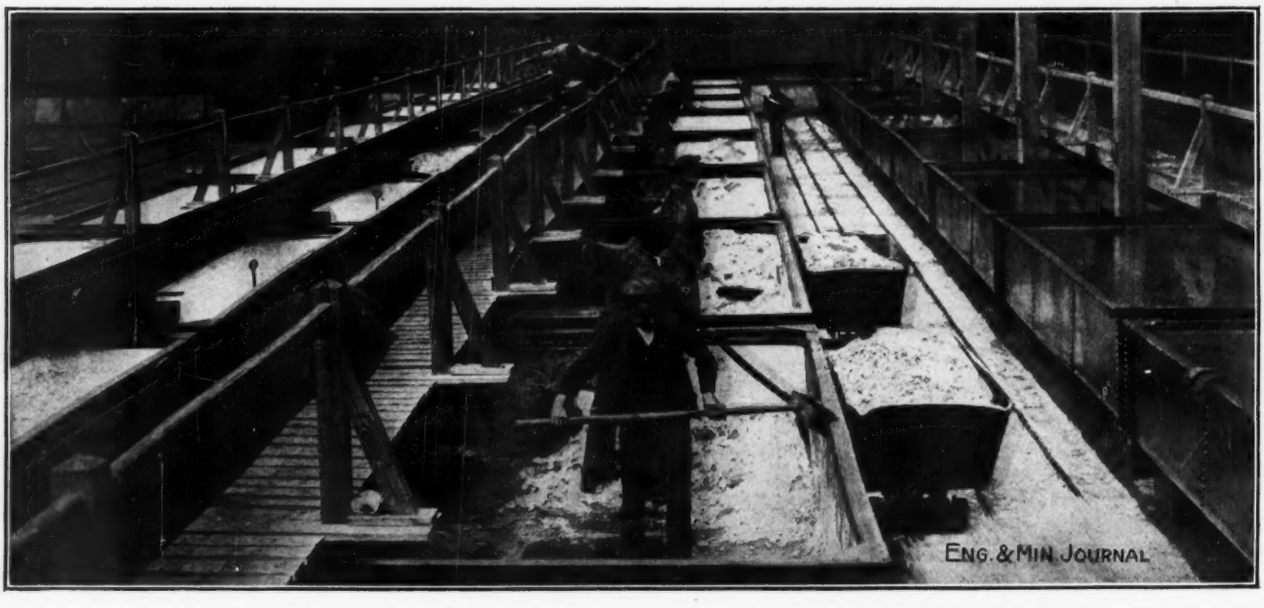

DIGGING OUT THE CRYSTALLIZED POTASSIUM SALTS AT A GERMAN POTASH WORKS

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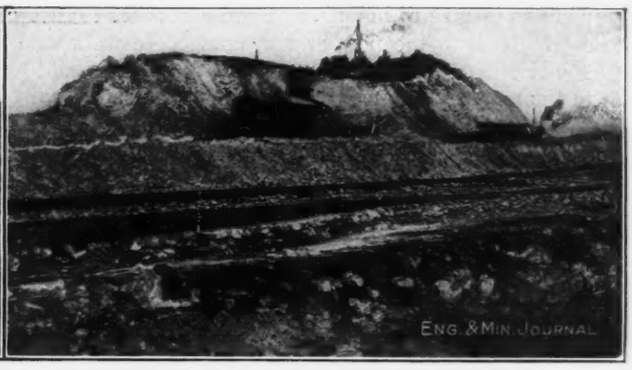
RECENT VIEWS OF NEVADA CONSOLIDATED STEAM-SHOVEL PITS NEAR ELY, NEV.

Liberty pit looking toward mouth from South.

Looking West across Eureka pit and toward Eureka Hill.

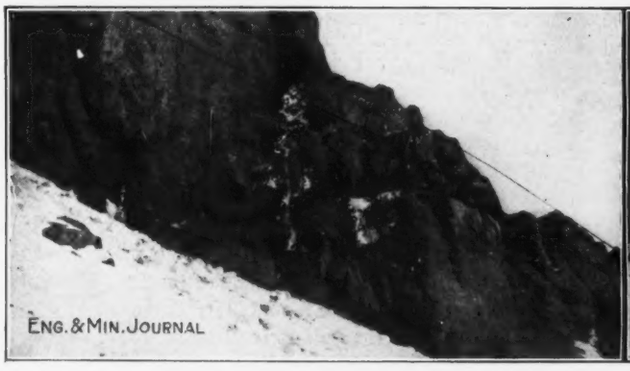


THE COPPER MINES CO.'S 100-TON SHOVEL

Shovel is at mouth of Liberty pit.

REMNANT OF APEX OF EUREKA HILL

This is between Eureka and Liberty pits.



MOTHER LODE COPPER MINES CO.'S AËRIAL TRAM ON MCCARTHY CREEK, ALASKA

One of the main towers built on cliff.

At mouth of tunnel on Marvelous claim.

LOOKING DOWN GULCH AND UPPER TERMINAL OF MOTHER LODE AËRIAL TRAM

There is telephone connection between upper and lower stations, 6002 ft. apart.

Kennedy Mine Explosion

By Lewis H. Eddy*

The following facts regarding the explosion in the Kennedy mine, Amador County, Calif., on Nov. 17, 1913, by which three men were killed, are taken from the official transcript of evidence before the coroner's jury at Jackson. The men who were killed were George Schance, M. Rupar, J. Achimovich. B. Denton was injured but survived.

Alexander F. Ross, mine foreman, stated that at 12:30 the skip carried the men and tools down. He intended to get off at the 3600-ft. level, but when he came to the 3100-ft. level he was informed of the explosion. He ordered the opening of a raise to let the smoke out and directed the removal of the four men. Schance intended to blast at 3:30 o'clock, and he was intending to get his primers to take to his place of work in order to save him a trip back to the powder magazine. He worked about 900 or 1000 ft. from the magazine. It was the habit to ge to the magazine for powder caps and fuse before quitting time when it was necessary to have them. Schance had two holes to drill in hard, tight ground, and had to carry his tools back and it would keep him busy. He evidently intended to save time by getting the powder and fuses on his way. Rupar went to the bench where there were five full boxes and a half box; after the explosion there were four full boxes and a box with some powder in it. Evidently Rupar took one of these boxes of powder to take to near where he worked. Schance was at the fuse bench. The caps and fuse were kept on the same bench, and the powder about 15 ft. distant. Denton was at the timber truck directly in front of the magazine, about 25 ft. from the powder bench. He was on the north side of the straight track. It hardly seems possible that one of the caps could explode and set off the one box of powder and not set off the rest. Schance had a knife to cut fuse with. They always cut fuse on that bench. The caps and fuse lay on that bench and the powder on the other bench. The usual way of crimping is with knife or crimpers. It is hard to keep crimpers, for the men take them. Ross had a case a year or so ago when an Austrian was crimping with a knife and the knife slipped and the cap exploded. He did not know whether Schance used a knife or crimpers. He said he would fire a man if he caught him biting the fuse. Ross did not believe that the box of powder was taken to the timber on the truck, but that one stick of powder was on the timber truck and directly opposite the powder. The timber which Denton and his partner were cutting was 12x12 in. by about 16 ft. long. Undoubtedly the timber was broken in two by the explosion. As a rule, the powder would not explode if the box had fallen from the man's shoulder. It might happen once in a hundred times. And as a rule, the temperature would not cause an explosion. The powder is sometimes taken out to let it thaw.

Denton was conscious when picked up. He said: "What struck us, boys?" Achimovich was found in the main crosscut about 45 or 50 ft. east of the little drift where the powder is kept. Schance was employed running a machine drill. Rupar was his partner. Denton and Achimovich were partners. Schance and Denton, Americans and first-men, were paid $3 a day. The others were Austrians and second-men, paid $2.50 per day.

Joseph Hicks stated that he and his partner left the station at 12:30, and in going into the crosscut he saw Schance sitting on the cap and fuse bench. Schance borrowed his knife. He saw Schance getting ready to walk toward the powder maxazine. It was about 12:35 when he gave Schance the knife and the explosion occurred about 3 to 4 minutes after they had passed him. He could not see whether Schance was in the magazine or not, and did not see Rupar there at all. Denton was sawing a timber.

C. W. Hintmann said that he passed Denton who said he wanted him directly to help put up a cap which he was sawing. He went around the turn and sat down to wait when Hicks and his partner came along and in a second or so the explosion occurred. It took Hintmann's cap off his head and the lights were all out. There was no powder on the timber or timber truck when he talked with Denton. He believed that whoever took the powder out of the magazine had it on his shoulder.

All of the witnesses testified that they believed the explosion was wholly accidental. The verdict of the coroner's jury expressed the belief that the explosion was accidental, but in what manner it was brought about the jury was unable to determine.

*Of editorial staff, "Engineering and Mining Journal," 3430 Peralta St., Oakland, Calif.

Tin in the United States in 1913

The 1913 production of tin in the United States was about equal to 50 short tons of metallic tin, from five localities, according to the U. S. Geological Survey.

Three of the producing localities were in Alaska and one each in South Dakota and South Carolina. In Alaska the York Dredging Co., working on Buck Creek, about 15 miles east of Cape Prince of Wales, produced 65 tons of stream tin carrying approximately 68% of tin. The dredge ran only about six weeks, a dry season preventing longer operation.

On Lost River, 20 miles south of Buck Creek, the Jamme Syndicate, in order to test the ores from the lodes at that place, put up an experimental concentrating plant, in which 49 tons of ore gave 5000 lb. of concentrates carrying 62.5% of tin and 11.1% of tungsten. The company is said to have developed a considerable quantity of similar ore and to have larger plans for future work.

On Brooks Mountain, a few miles east of Lost River, prospecting was done during the year but no tin was produced. It is reported that on Sullivan Creek, near Hot Springs, on the south side of lower Tanana River, Alaska, about two tons of stream tin was taken out during the summer.

A little more than a ton of concentrates was shipped from the vicinity of Tinton, S. D. The Cherokee Tin Mining Co. took 5700 lb. of cassiterite out of residual placers at Gaffney, S. C.; the product carried 71.5% of tin and was sold for 34c. per lb. of concentrates. The company did some prospecting by drilling and expects to work the lode. The old gneisses forming the country rock in which pegmatites carrying cassiterite have been intruded are so disintegrated that they can be worked by pick and shovel for many feet in depth.

In North Carolina the Piedmont Tin Mining Co. did some development and prospecting work at Lincolnton, but made no production.

Fractional Smelting in Rotary Furnaces

A German patent (No. 266,221) has been awarded to H. Specketer for a smelting process for miscellaneous ores, involving the use of producer gas in a rotary reverberatory furnace, like that used in the Le Blanc process. The pulverized ore is mixed with coal and charged intermittently into the furnace. Rotary furnaces generally operate continuously, and although economical of heat, they are open to the objection that the temperature is not capable of accurate control. With an intermittent process, on the other hand, the temperature can be raised gradually and in carefully regulated stages; this is especially advantageous in the treatment of ores containing a variety of metals, having different temperatures of reduction, since it permits the recovery of each metal uncontaminated by the others, the recovery being made as bullion or as oxide.

As fuel, producer gas is burned in the furnace, with admixture of air, the proportion of which can be so regulated as to maintain reducing conditions; by keeping a very thick bed of charge, the more strongly heating oxidizing flame can be used without danger of preventing ultimate reduction of the metals. Uniformity of temperature is maintained by varying the direction of the flame. As the temperature rises, the easily reducible metals, such as lead, are first liberated and can be tapped off before they volatilize. Sulphates are reduced to sulphides. With increasing temperature, the more resistant metals are next obtained, and are separated in a forehearth. When reduction is complete, the admission of air is stopped, and the remaining charge is worked over or allowed to cool in a stream of the reducing gas from the producer. To prevent sintering of the charge, a coarser size of coal can be used.

To economize heat, the escaping gases can be utilized to preheat either the charge, or the air blast. To the same end, it is advisable to arrange the furnaces in pairs in the same setting, or to divide one long furnace by a partition wall at its center; while the reduction process is going on in one part, a charge can be preheating in the other. If sulphides are to be treated, they can first be roasted in the furnace in the ordinary way, and then coal can be added and the reducing operation begun.

The advantages claimed for this procedure are: (1) Close regulation of temperature; (2) little or no flue dust produced; (3) small amount of attention required; (4) complete reduction is possible while utilizing any convenient fuel.

Molybdenum Ore Prices

A subscriber asks for weekly quotations on molybdenum ore. It is impracticable to give market quotations weekly or even monthly for molybdenum ore as the market is still too limited and too easily demoralized by any large shipment. However, according to a leading buyer, the prospects for molybdenum are much better this year. The standard ore should contain a minimum of 85% MoS_2.

Such ore would be worth from $8 to $10 per unit, providing the ore be free from copper, arsenic, bismuth and tungsten. Any one of these elements will reduce the price of the ore. For instance, 90% ore free from these elements is at present worth $12.50 per unit—practically twice the price of tungsten ore. Lower grade ores are worth much less. In addition, ore shipments arrive unexpectedly sometimes, and as soon as there are accumulations of ore, the prices drop suddenly. On account of these conditions, it is impracticable to name standing prices that would be of assistance to shippers.

Production of Tungsten in 1913

Tungsten ores were produced during 1913 in six states —Colorado, California, Idaho, Arizona, South Dakota and Nevada, according to the U. S. Geological Survey. The output for 1913 was equivalent to 1525 tons of ore carrying 60% of tungsten trioxide (WO_3). The production was 1330 tons in 1912; 1139 tons in 1911, and 1821 tons in 1910.

As heretofore, the Boulder County field, Colo., was the largest producer, with an estimated output of 953 tons of ferberite in 1913, against 812 tons in 1912.

The Atolia district, California, was the second largest producer, and still makes a larger production of scheelite than any other district in the world. Nearly all the output was produced by the Atolia Mining Co., but small quantities were also produced from several mines at Atolia and the Stringer and Randsburg districts on the north.

Some wolframite was produced in the Clark Mountain region, in southeastern California. In Arizona scheelite was produced in the Old Hat district, 40 miles north of Tucson. Other than the Atolia district, this is the only district in the United States from which a production of scheelite is made.

Some hübnerite was produced in the Arivaca region, near the Mexican boundary line, south of Tucson, and at Dragoon, east of Tucson. A little hübnerite was also produced at Round Mountain, Nev., and in the Blue Wing district, Paterson Creek, Idaho.

No production is known to have been made in Washington during the year, but a small quantity of wolframite concentrates produced in 1912 in the Cedar Cañon district was sold.

A mill was erected at Hill City, S. D., and a small quantity of wolframite was concentrated and part sold.

Prices were better in 1913 than in 1912, and ranged from $6 to $7.50 per unit of 20 lb. of tungsten trioxide.

Melting Points of CaO, MgO, Al_2O_3 and Cr_2O_3

The melting points of lime, magnesia, alumina and chromic oxide were recently determined by C. W. Kanolt (Journ. Franklin Inst., p. 587, 1913).

The oxides were melted in a graphite resistance furnace, using a Morse optical pyrometer for measuring the temperature. Smoke was avoided by use of a high vacuum or by a gentle current of an inert gas (hydrogen). Magnesia and alumina were melted in graphite crucibles, alumina, lime, and chromic oxide in a tungsten vessel. Lime was also made into tubes which were supported by the upper end in the cooler part of the furnace. The results were as follows:

Oxide	M.pt., °C.	Number of Determinations	Average Deviation
Magnesia	2800	6	13°
Lime	2572	5	3°
Alumina	2050	8	4°
Chromic oxide	1990	5	6°

Correspondence and Discussion

Hardinge vs. Chilean Mills

The able theoretical exposition of the action of central forces, as outlined in A. O. Gates' discussion[1] of Robert Franke's paper relating to the chilean and Hardinge mills, is of special interest to me. Mr. Gates' article, even though a criticism of the particular construction of the conical mill, is one of the best indorsements of the mill that has so far been written, tending to prove it to be a practical exception to theory. I cannot but feel flattered by the fact that I have invented something which graphic theoretic formulas prove to be impossible. Mr. Gates questions the possibility of work performed and says: "Perhaps I am like the sailor's mother who could credit his story about the mermaids, but refused to believe what he told her about the flying fish. The segregation of the pebbles is entirely reasonable, the survival of the most

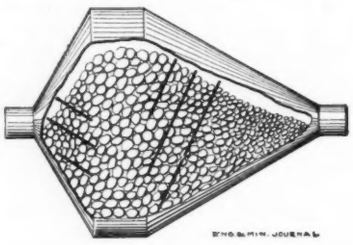


FIG. 1. ILLUSTRATING CROWDING ACTION OF PEBBLES IN CONES ON THOSE IN CYLINDRICAL PORTION

energetic, but how can the fines separate themselves from the coarse in the turmoil taking place within the crushing zone?" This can be answered by conjecture based upon practical results. The probability is that the voids between the pebbles act as a screen. Material travels forward by displacement in proportion to the size of screen opening until it meets a screen where further division is necessary for it to pass; at least such a result is indicated by the 20,000 tons of ore now being ground daily in Hardinge mills. No one would claim, or reasonably expect, that the small amount of 100-mesh material which is produced in the first reduction of a ¼-in. particle to a smaller intermediate size would immediately find itself in the 100-mesh zone. What we do claim is when it has reached its 100-mesh position, or zone, it is not then acted upon by a force equal to that required to crush the original ¼-in. particle, as is the case in a cylindrical mill, throughout the length of which the forces are equal.

We beg to make the observation that we are somewhat in the position of the man who had his attorney visit him in prison to consult upon his case. The attorney informed his client that they might fine him, but could not imprison him for his offense. The client's remark was certainly apropos of existing conditions when he said to his attorney, "That's all very well, and perhaps according to book law, but where in blinkety blank *am* I?"

[1]"Eng. and Min. Journ.," Jan. 3, 1914.

The Hardinge mill in its operation, is a practical, non-theoretical device. Though primarily fathered by theory, the parent would hardly recognize its own child, owing to characteristics later developed. Mr. Gates' figures, however, are based upon different premises than those existing in the conical mill under working conditions. I could not, if I desired to do so, prove his hypotheses and figures as incorrect; they simply do not apply to the Hardinge mill when in operation. I do not lay claim to a discovery of new conditions, but an application of well known laws in a new combination. The size of pebbles taken for demonstration—by scaling Mr. Gates' diagram—is apparently about 4 in. in diameter and the mill 8 ft. diameter by 22 in. length of cylinder. So far so good. The criticism that I would make is that he apparently deals only with the individual rows of pebbles instead of the mass as a whole, and fails to consider those nearer the axis as

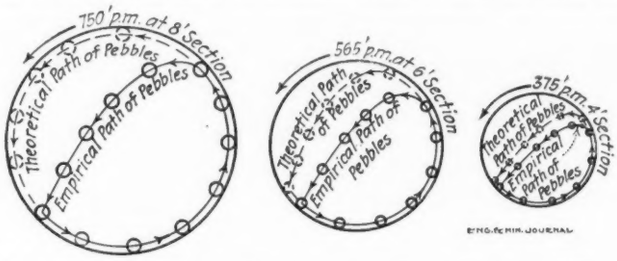

750' p.m. at 8' Section
Theoretical Path of Pebbles
Empirical Path of Pebbles
565' p.m. at 6' Section
Theoretical Path of Pebbles
Empirical Path of Pebbles
375' p.m. at 4' Section
Theoretical Path of Pebbles
Empirical Path of Pebbles

FIG. 2. ACTUAL AND THEORETICAL CONDITIONS AT DIFFERENT SECTIONS OF A CONICAL MILL

influencing rows farther away, limiting forces to action on one line of the same size of pebbles throughout the length of the mill, instead of graduated sizes and graduated effects. No frictional resistance is considered. The theoretical pebble charge is whirled around in air without accounting for retarding friction. Slippage of the charge on the inside of the shell, due to a mass of roller bearings in the form of sand particles, is not considered. Nor does he account for the fact that absolute inertia must be overcome in half a revolution, from point of falling charge back to final drop.

The actual conditions existing in an operating mill are, I believe, beyond the possibility of a theoretical analysis. Mr. Gates appears to have taken no account of the medium in which the pebbles are acting. This added influence would apply to both wet and dry crushing. My personal opinion, particularly in cases of wet grinding, is that the high possible speed of the mill is due to the viscosity of the contents, *en masse*. Thus the inner portion of the charge, that nearer the axis, being of the greater volume and operating far below the critical point of centrifugal cling, has an adhesive retarding action on the outer layers of pebbles at the periphery of the mill, binding the outer to the inner pebbles, which latter exert the greater mass influence.

Again, the pebbles in the cones under the action of gravity seek the lowest point (greatest diameter) of the mill, producing oblique lines of force impinging or crowd-

ing upon the central mass, as indicated by arrows in Fig. 1, preventing a free action of such central mass. Fig. 2 will illustrate the difference between the theoretical path of the pebbles (shown in dotted lines), as advanced by Mr. Gates, and the actual empirical conditions, based upon the observed operations of the mill (shown in full lines). These are computed for three different sections of an 8-ft. diameter mill—8 ft., 6 ft. and 4 ft.—revolving at a peripheral speed of 750 ft. per min. at the largest section, a speed to which Mr. Gates takes exception as being impossible. Two 8-ft. Hardinge mills have been operating in dry crushing, for three years at 800 ft. per minute, through an original error in the size of pulleys. When we suggested a reduction of speed, we were met with "What's the use? We are now doing more than you claim for the mill." This was the reply of a successful business manager, a man with a college degree. There are no "dead zones" in his business or judgment.

One of the main features of the Hardinge mill is the classification of different sizes of pebbles in different zones

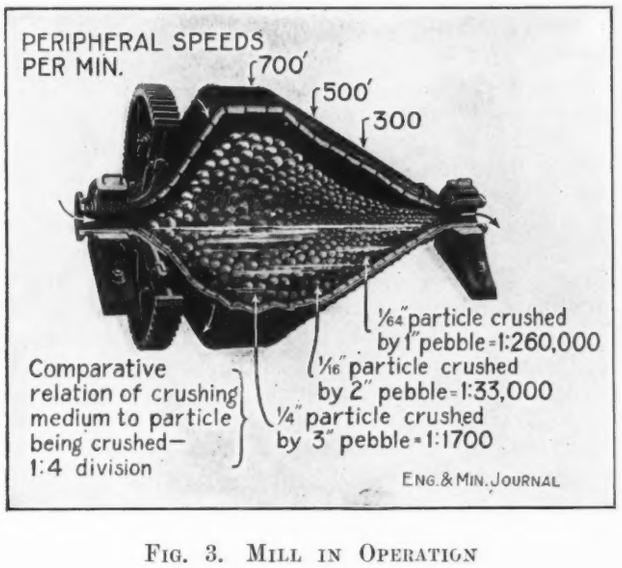

PERIPHERAL SPEEDS PER MIN.
700'
500'
300
1/64" particle crushed by 1" pebble=1:260,000
1/16" particle crushed by 2" pebble=1:33,000
1/4" particle crushed by 3" pebble=1:1700
Comparative relation of crushing medium to particle being crushed—1:4 division
ENG.&MIN.JOURNAL

FIG. 3. MILL IN OPERATION

of the cone. It will not be out of order for me to quote further from a paper of mine, bearing directly upon this point, as follows:

> In the conical mill the largest pebbles or balls, the greatest superincumbent weights, and the greatest peripheral speeds all segregate at the greatest diameter of the mill, likewise other sizes seek zones or positions in proportion to mass and weight acting in conjunction with gravity and central forces. The same rule holds good in regard to the particles undergoing division, in which it will be noted that the grinding mediums automatically adjust or classify themselves to the work to be performed, embodying a step or stage reduction within a single achine through a combination of percussion and attrition, as illustrated in Fig. 3.

If according to Kick's law, the energy necessary to crush a particle is in direct relation to volume of particle, then even in spite of reduction of 1:3 in size of pebbles, the 1-in. pebble in the zone with the $^1/_{64}$-in. particles has, roughly, 150 times the energy, in relation to the work to be performed, of the 3-in. pebble working in the zone of ¼-in. particles. This apparent excess energy in the cone is more or less equalized through a decrease in peripheral speed and consequent reduction in the crushing force applied. The cone portion contains a much greater number of pebbles, the surface of which, per unit of weight, increases in direct proportion to the decrease in diameter of crushing medium (pebbles).

I never have claimed, nor do I desire to effect, percussive crushing alone in the cone. It is in the cone that attrition mainly acts on the previously broken particles, where also fairly regular reduction in size of pebbles exists.

One cubic foot of 4-in. pebbles in the large diameter of the mill has a total crushing-surface exposure of 1360 sq.in., while a cubic foot of 1-in. pebbles near the apex of the cone has a surface of 5440 sq.in. The capacity of any crushing device is in direct relation to the crushing surface exposed, plus proportionate power. If more material is being fed than can possibly be ground and a choking occurs, the conical mill will, in a very few minutes "cough up its undigested food" owing to grading migration.

Those who have had experience with overfeeding cylindrical mills, realize that it often requires several hours to regain normal conditions, as there is no automatic migration.

It is not my desire to ask irrelevant questions, but I would like to know how far a flying fish would be expected to fly if it were obliged to lift itself out of a sea of mud? The question, I believe, is a pertinent one and directly applies to the pebbles within the mill, which certainly do not fly as far as they would in water or air, because of the enveloping medium, nor would we expect more of the fish under similar conditions. We share the doubt of the sailor's mother about the flying fish; not its existence, but simply its ability to fly freely when subject to constantly changing environment.

As the Hardinge mill does not operate under the theoretical conditions cited by Mr. Gates, it would be most interesting to have a formula outlined, based upon an operating conical mill, taking into account:

(a) Graduated sizes of pebbles and different sizes of feed.
(b) These same pebbles operating in air.
(c) Pebbles operating in clear water.
(d) Pebbles operating in a mass of water and sand, producing a viscous medium of mud containing hundreds of different sizes of meshes of material undergoing disintegration, such medium having a specific gravity varying from one of pure water to at least two or more of a mixture of sand, slime and water.

I had formulated theories as a basis for my mill, built different devices to test the theories, and finally consigned them all to the scrap heap. I finally designed a practical mill from empirical results based on observation, as shown by an electric light projected within the mill while in operation. There is no doubt that critically exact inclinations for the cones exist for each and every ore, but I am not ready to state what they may be. Certainly there are no "dead zones" in the Hardinge mill. I am, however, positive that it is beyond the possibility of theory to define a rule, or set of rules, which will apply to the greatly varying conditions within the ordinary pebble mill, more particularly the conical mill. I can assure the theorizer that he is doing both himself and me an injustice in promulgating formulas for the working of the Hardinge mill without practical observation. A suit of overalls, a shovel and a set of testing screens will be more effective than lead pencil and textbooks.

Like conditions produce like effects, and in summing up effects we should consider conditions causing the effects, nor must we lose sight of the fact that surface friction is a factor of considerable importance in the action of gravity.

H. W. HARDINGE.

New York, Jan. 15, 1914.

Grinding Ores for Cyanidation

With reference to R. B. T. Kiliani's letter on this subject in your issue of Dec. 6, and H. A. Megraw's comments thereon, perhaps a brief summary of our experience with Hardinge mills at the Mary Murphy mine (where we are grinding a complex ore for concentration) may be of interest.

We crush with rolls (dry) to ⅛ in. The crushed ore is screened by trommels with 1-mm. round holes, the —1-mm. product going to a string of pulsating classifiers, and the +1-mm. to jigs. The heavy, relatively soft, jig middling is reground in a 4-ft. Hardinge pebble mill, and the hard jig tailing in two 6-ft. Hardinge pebble mills and one 3½x16-ft. Gates tube mill. The coarser sands from the tables which are fed from the first two spigots of the classifiers, are returned to the tube mill, which thus receives a somewhat different feed from that furnished to the Hardinges. For a considerable period, however, the feed was equally divided, so that we had an excellent opportunity to compare the results. Acting on Mr. Hardinge's opinion, we originally made no provision for screening out oversize; but soon found it to be necessary, in order to avoid running coarse particles into the table concentrates. We are still unable to do this directly, as would be preferable, but have adopted the alternative plan of screening out the oversize by means of a small trommel below the first classifier spigot.

As to the 4-ft. Hardinge, we have found no way of avoiding undue sliming when crushing relatively soft, heavy feed, and are arranging to recrush our jig middling by rolls, reserving the small Hardinge to help maintain production when one of the larger Hardinges or the tube mill happens to be laid up for relining or other repairs. We find that with all the Hardinges the proportion of —200-mesh material (which in our case is undesirable) is reduced by adding more water, of which we have tried various proportions from 50 to 80%. The most efficient way to lessen sliming, however, is to crowd the feed beyond the capacity of the mill for complete grinding, which involves increased oversize material (in our case anything over 40-mesh is oversize). We find the capacity of the tube mill and of one 6-ft. Hardinge is about the same, from 40 to 50 tons per 24 hr. The Hardinges cost a little more. As we drive all machines off line shafts, we have no way in which to estimate the relative power consumed. The discharge of the tube mill, owing, no doubt, to its excessive length, can be kept free of oversize, and its operation can be regulated so as to make very little more slime than the Hardinges.

It may be wondered why we adopted 6-ft. mills when one 8-ft. mill might have done the same work. The reason was that we started with one 6-ft. Hardinge, but found its capacity to be less than was estimated by the makers, and therefore decided to duplicate it. In any case, owing to the reduced weight of the mass of pebbles in the mill, I incline to think mills of smaller diameter slime less. To my mind, the conical end of the Hardinge is the secret of its success. I cannot conceive that there is really any effective stage crushing, such as Mr. Hardinge describes in his articles, for the effect of the combination of the smaller size of pebble and reduced peripheral speed at the small end must be such that practically no real grinding can take place there.

I think the conical end improves the discharge in much the same way in which the device recently patented by Chalmers & Williams is expected to aid that of an ordinary cylindrical tube mill. The conical end may be slightly the less effective of the two, but it is simple and adds nothing to the cost of the machine. What the alternative device will accomplish in practice remains to be seen. Our Hardinge mills are all 22 in. in length of the cylindrical portion. For fine grinding, I fully believe that longer cylinders should be adopted. I cannot, however, think that any machine of the tube-mill type, in which classification necessarily takes place, can ever be a perfect grinding machine where a minimum of slime is required.

GEORGE E. COLLINS.

Denver, Colo., Dec. 17, 1913.

Metallurgical Investigation

In the West are many properties with such complex ores that their owners are discouraged and have concluded to shut down until such time as a process is found able to make a profit on the operation. During the last few years many excellent operators have devoted a great deal of time to the question of the extraction of metals from these complex ores, and some of them have reached a point which permits many properties to go forward. But there seems to much laggardness among the owners of these properties, in learning the facts. Here is a case in Colorado.

A mine with a complex lead-zinc-gold-silver ore has blocked out some 18,000 tons and has about 4000 tons on the dump. The vein varies from 2 to 4 ft. in width. The assay values computed by the assayer, at the present price of metals, reaches a total of about $33. The directors of this mine include a physician in St. Louis, who is general manager; an architect, who is the mill superintendent, has visited Joplin several times, but never made any study of milling. The mine foreman is an Italian of limited mining experience. Of course, you might say this is not typical; but I mention it to show the human elements in the mining game.

With the intelligent application of modern, uptodate processes, this ore can be treated at a satisfactory profit. A test of it in Denver showed salable products amounting in value to $16.77 per ton. The cost of treatment, of course, would vary, but admitting that, including the cost of mining, it would amount to $5, this mine has net in sight some $200,000.

I could give the percentages of the extraction of the various metals, which would show that this process can do the work profitably; but the point is that there are processes now which can make some properties valuable, even though the percentage of saving is not so high as that secured on a single metal, or as high as it will be as time goes on.

It cannot be repeated too often that one of the chief needs in the mining realm is more intelligent investigation, both into the possibilities of abandoned properties and into modern processes, which even the schools have not yet begun to teach generally. Admittedly, there are processes and processes; but the higher the intelligence of the investigator, the more profitable will be his findings. There are now several properties in Colorado which are doing profitable work, which four or five years ago could not operate.

S. EARL BENNETT.

Denver, Colo., Jan. 13, 1914.

Editorials

Again the Prosperous Calumet & Hecla

Secretary Wilson is again informing the people of the iniquities of Calumet & Hecla, not "confidentially" this time, for apparently even the bureaucrats seem to have wakened up to the fact that the millions of Calumet & Hecla dividends have been published year by year since there was a Calumet & Hecla. There was an original investment, we gather, of $1,250,000 which has paid $121,000,000 dividends and the company has made reinvestments variously stated, according to state of mind of the official interviewed, at $25,000,000 to $75,000,000.

Since Calumet & Hecla is so successful, it has underpaid its laborers, which is a social crime. Mining dividends should be limited to 3½%, possibly 5%, we suppose, that labor may receive its due. Cannot even a Government official understand that many mining investments are not profitable, and that a man going into several will probably need tremendous profits on one in order to break even? If a man had put equal amounts in all the Michigan copper companies that have been chartered, and had used his dividends to keep his assessments going, where would he probably stand today?

But this is a train of thought which does not appeal to the head of the Department of Labor. The successful mines should pay savings-bank interests and the investor in the unsuccessful one should cheerfully see his savings disappear, for has he not supported the Federation of Miners meanwhile.

That under these conditions the investor will buy British consols and hope that he will eventually be able to emigrate to Russia, will be evident to certain unprejudiced thinkers, but probably not to the followers of the New Freedom of the school of economics.

In passing, we desire to call the attention of the followers of this school, not for their enlightenment, as that is beyond us, but for our own relief of mind, that because a million-dollar company pays two millions in dividends such does not always signify iniquitous profits. Money is entitled to some interest, according to most authorities since the Merchant of Venice, and with mines amortization is also necessary. A million-dollar mining investment repaying two million dollars in 16 years, with exhaustion of the orebodies, has not been remarkably remunerative.

The Calumet & Hecla mine was one out of ten thousand. In a different line a similarly brilliant success was attained in the manufacture of the Ford automobile. Mr. Ford lately decided to divide his profits among his employees and to do it in the form of a $5 per day minimum wage, no man to be discharged under any circumstances. Undoubtedly this system of distribution meets with the approval of Brother Wilson and Brother Moyer, and apparently they would have the Calumet & Hecla do likewise. The wisdom of Mr. Ford's plan is seriously questioned by economists and sociologists, and naturally it disturbs his less fortunate competitors, some of whom are scarcely able to make both ends meet. If our recollection be correct, the Calumet & Hecla itself during one period of its history paid more than the market rate of wages and experienced an inefficiency in production estimated to have been equivalent to $25,000,000. No one benefits by that sort of thing. It is just waste.

Mining in Sonora

In Sonora the operation of the mines is now going on as if nothing had ever happened. Sonora has seceded and no Federals are in sight. The state government runs things on its own hook, but neither has nor has claimed any national rights. This produces embarrassments. It has no coinage and currency is scarce. The supply of Federal postage stamps has run out and those of the sovereign state of Sonora do not carry in the United States. Consequently Americans put United States stamps on their letters and pay three cents into the state postoffice. The latter undertakes to carry them to the American border and mail them there. Thus we see foreign postmarks on American stamps, a philatelic curiosity.

The state government collects all the revenues and thus has some resources. The mining companies pay their property taxes in the state and also in the City of Mexico, a double payment, but it is not worth while to take any chances on what is relatively a small matter. According to press dispatches, yesterday, the government has enacted a new mining law, effective Jan. 16, conferring titles to properties. It is said that "hundreds of properties have been lying idle, and officials hope that by granting valid titles, owners will be persuaded to operate the mines, thus relieving poverty among the lower classes. Those who comply with the provisions of the new law are guaranteed a valid title. At present the titles issued are only temporary, but will be recognized by the Constitutionalists, and replaced with permanent titles if the insurgents gain control of the entire country."

We don't know just what this means, but no doubt the mining operators will conform to it, whatever it be and try to conform also to the old law. Anyway, it is gratifying to be able to look at one part of Mexico where order prevails and where mining is going on.

Mining's State of Health

The much vexed question of the existing stagnation in the mining industry is discussed in this issue by Arthur M. Swartley, with much more intelligent consideration than the subject usually receives. Certain misconceptions attend the common attitude toward the condition of mining. Stagnation does exist, but only in certain regions. There is no stagnation, so far as we know, in the Central and Eastern states, nor in Arizona, nor in Ontario, to go outside the boundaries of the United States, nor in Alaska, especially Juneau. Certain good old mining states, particularly Colorado, have been experiencing

lean years. The many engineers or miners living or operating therein, seeing that mining is languishing immediately around them, imagine that this condition extends over the whole country, and foresee a general ruination of the industry.

However, it is true that there has been for several years a general slackening of activity in the promotion and development of new properties, not of the big ones, but of the middle-size and little ones. The JOURNAL has previously attributed this slackening to the fact, among others, that ore deposits are becoming harder to find. Certainly the mine that pays its way from grass-roots down is not as common now as they were in the early days of Eureka, Leadville and Cripple Creek. Mr. Swartley insists that mines are as plentiful as ever, but that the incentive is lacking to discover and develop them. We are willing to admit that the methods of prospecting and handling prospects are sadly inadequate today. But the point of view that a prospect is essentially something to be sold, is one that we cannot indorse. Why not work it? It is precisely this disinclination to back one's own horse that is largely responsible for the localized stagnation in the industry. So long as an owner of a prospect lies back and waits to catch a customer, just so long will mining be stagnant around that prospect. Having said this, we may admit that some mines cannot be developed except by operators with larger resources. The proposal, therefore, that experienced engineers should take hold of and work such properties, is a timely one. A successful example of this method is the recent reworking of the Tightner mine, in California. Certainly, plenty of engineers are available now, with Mexico running on half-time, and their entrance into the field of the owner-manager should prove the solution to several problems.

At the same time, we do not think that the great exploration companies are now fulfilling their legitimate function in the economic organization; prospects are neglected by those who could most safely take them up. Theoretically at least, the greatest risk in mining should be assumed by those with the greatest resources, and the operation of greatest risk is unquestionably the conversion of the prospect into the developed property. The risk can be overcome only by dealing with prospects in wholesale lots, quantities large enough to give scope for the operation of the laws of chance. The failure of the exploration companies consistently to enter this field lends more than a little point to the gibe of the small operator, that they are looking only for sure things at outrageously low prices.

The correctness of Mr. Swartley's statement that a good property in the hands of an honest, but incompetent man will invariably lose the investor's money, hinges on the defination of "good." One hard-headed and successful old operator, asked for his idea of what constituted a good mine, said, "Lots of mines will pay, if handled honestly and intelligently; lots will pay even when poorly managed, if they are not grafted; but a real, *good* mine, is one that will stand grafting and mismanagement and still pay big."

The promoter and the amateur, meaning by this not those downright dishonest, but those unduly rash, are undoubtedly to be credited with the more or less accidental production of many good mines in the past. The last six years have seen little of their activity, and little will be seen in the future until a prolonged bull movement in business and finance, piles up a large supply of easily-got money, which may be as easily tapped for hazardous mining schemes.

The suggestions for the reorganization of geological survey methods, we find excellent. The value of governmental geological work so far has been largely indirect Usually the survey comes in when the success of the camp or the mine has been established, and the results of its work are valuable only as applied to other districts. The scheme, which seems about to be adopted in Oregon, of making prompt reports, keeping in current touch with all new districts and being a leader rather than a follower of the industry, is one which gives the greatest promise. There will always be danger, however, if the attempt is made to indicate the value of individual properties. The opportunity for graft and misrepresentation is too obvious.

We believe that most of our readers will be grateful to Mr. Swartley for not attributing the mining stagnation to the machinations of the Forest Service. That often mistaken, but fundamentally honest and much maligned branch of the government has been experiencing a period of peace and quiet for some time now, for which no doubt it is grateful.

One thing is sure, mining is far from moribund, and no real decline is possible. The world is going to have metals; when it no longer pays to mine and prospect for these metals, prices will have to rise until mining and prospecting do pay, the readjustment being, of course, gradual. Every prospect of possible value is eventually going to be developed. Meanwhile, we commend to its owner a little earnest endeavor to develop it himself.

The Eruption of Sakura-Jima

It is an interesting coincidence that our description of the Yamagano gold mine, which began in the last issue, and is concluded in this, should appear at the particular time when the attention of the civilized world is directed to that section in which the mine is situated. The eruption of Sakura-jima, a volcano on a small island of the same name in Kagoshima Bay, a short distance from the shore in Satsuma Province, has practically destroyed its small island as a place of habitation and caused great loss of life and property in the city of Kagoshima. Satsuma occupies the extreme southwestern portion of the island of Kyusha, to the south of the larger and principal island of Nippon. The effect of falling ashes was felt in Nagaski, many miles away, and it is probable that the effect upon the Yamagano mining district has been important, if not disastrous. It is to be hoped there have been no calamities, and that the miners and the mines themselves are safe.

Just Piffle

Congress reconvened, and the expected uproar among the Solons began right on time. Senator Martine initiated measures for the government to take over all the coal mines; and "that the government take steps to acquire possession of the copper mines and operate them under union conditions" was the demand of resolutions by trade unions throughout the country, which poured into Congress on Jan. 20.

The resolutions came from many organizations, in industrial and mining centers, say the dispatches, and declared that conditions demonstrate conclusively the utter incapacity of the present mine owners to operate the mines in justice to labor, in safety to the community or in harmony with the welfare of the people of the nation.

Did anybody ever think that Doctor Douglas, Doctor Ricketts, and Messrs. Thayer, McNaughton, Denton, Channing, Yeatman, and Jackling knew anything about operating copper mines in safety to the community or in harmony with the welfare of the nation? Let Secretary Wilson inaugurate the Congressional inquiry that he urges upon the President and let Hon. Aristide Pujo and the Hon. Augustus Stanley fix things, with the assistance mayhap of the erstwhile Wolf of Wall Street, who has lately figured anew as the legislative assistant of disingenuous congressmen. The stocks of most of the copper-mining companies are listed and the government can buy them if it wants to. Or will it just decide to confiscate them? There is going to be a silly season in Washington.

The Wheeler and Krejci Converting Patent

A brief examination of the converting patent of Messrs. Wheeler and Krejci, referred to on p. 228 of this issue of the JOURNAL, seems to indicate that this is one of the most important patents granted in this field in recent years. The formation of a protective coating of magnetite is the factor that has permitted the production of the great tonnages of copper from the basic-lined converters, and is the almost universal practice where basic-lined converters are used. Hence, if priority can be established, the Wheeler and Krejci patent becomes of far-reaching importance to the smelting world.

The patent claims are broad, covering a "process of forming furnace linings" by the oxidation of the base metals of the charge, and the segregation and diffusion of such inert metal oxides in a monolithic layer on the furnace walls. The application of the protective coating is not restricted to basic-lined vessels, nor is the protective coating limited to magnetite, but may be of any suitable base component of the charge. The Wheeler and Krejci patent seems to embody a more definite and patentable idea than the broader application of skill in operation, as developed by Messrs. Peirce and Smith. It is not our purpose, however, to discuss that phase of the subject which is within the realms of the patent attorney, but rather to direct the attention of metallurgists to the scope and possibilities of the patent.

Salting Placers in Santo Domingo

A dozen or more companies or individuals have, in the last decade, investigated the possibilities of alleged mining properties in the Dominican Republic. Most interest turned to the placers. Investigation by competent engineers did not, however, result in equipping any of them for operation. About eight years ago, A. O. Brown & Co. met its fate through promoting a company to operate Santo Domingo gold placers, learning too late that its samples had been salted. Yet the conviction that the deposits were worth further investigation persisted, and in the JOURNAL of Apr. 19, 1913, it was stated that Henry F. Lefevre had gone to make examinations. At that time, a warning was sounded against some brokers' circulars respecting the flotation of certain companies to operate placers in Santo Domingo. The JOURNAL advised those who had dreams of El Dorado to await Mr. Lefevre's return before untying purse strings.

Mr. Lefevre returned a few days ago, and this is what he has to say: "I have gone over the whole island, carefully prospecting for commercial gold deposits, especially dredging ground. All the data on hand show conclusively that commercial gold deposits do not exist in the island." Mr. Lefevre promises more information about economic conditions in the republic, which will not only interest mining engineers, but those who are looking forward to the commercial expansion "about due" on the island.

The index of the ENGINEERING AND MINING JOURNAL, for the period from July to December, 1913, is ready. It will be sent to any address on receipt of a post card requesting same.

The cyanide article, by Herbert A. Megraw, on "Chemicals Used in Cyanidation," which was to appear in this week's issue of the JOURNAL will appear on Jan. 31, 1914.

BY THE WAY

The U. S. Civil Service Commission announces the postponement from Jan. 21 and 22 to Feb. 18 and 19 of the examination for laboratory assistant in petrography (see ENG. AND MIN. JOURN., p. 35, Jan. 3, 1914). The salary should have been stated by the Commission at $1400 to $1800, not $1200 per annum.

Political insistency on hard times is rather handicapped, says the *Evening Post,* by the insistency of practical business circles that the clouds are breaking. In Wall Street, it has become an accepted formula to describe 1913 as "the year of the panic that never came." Congressional orators can always take refuge, however, in the retort that the panic really came, even though no one saw it—much as they contended, after October, 1907, that there was no panic, even though every business man was aware that he was caught in it.

The *Miners' Bulletin* is a paper published by authority of the Western Federation of Miners "to tell the truth regarding the strike of the copper miners." In an issue which came to our notice we read "truth" of the following kind:

MINE OWNERS CLUTCH FOR PROFITS OVER COFFINS OF THE BABIES

The ghoulish fiends of Michigan who have sought to force their hyena heads over the very corpses of the babies of the Calumet miners in order to gain some morsel of concession to the profit appetite of the copper barons, have sunk to hitherto undreamed of depths of depravity, which the servile press of Milwaukee and the nation seems eager to share.

"Truth" is notoriously a variable factor when it be invoked for a purpose. But this is a case of "enough said."

Recent Work at Old Dominion

During December, at the Old Dominion mine of the Old Dominion Copper Mining & Smelting Co., at Globe, Ariz., the pump winze, which was sunk from the 1600 level to the 1800 level 18 months ago, and which had been allowed to fill with water, was unwatered and a big pump station and sump will be cut on the 1800. The "A" shaft will then be extended down to the 1800 and drifting will start east and west. Two 1200-gal. electric pumps will be installed on the 1800. A winze will also be started from the 1600 on the west side.

During the last year several notable improvements were made in the mine. In September, the old method of hoisting ore in cars on cages was replaced by skip hoisting. Skip pockets were cut on the principal levels into which the ore is dumped from the mule and motor trains. Skips of 3½ tons capacity hoist the ore to the surface and feed it to a conveyor belt leading to the crusher plant, where it is crushed and later automatically sampled and conveyed into storage bins. Use of the old crushing plant and sampling system was discontinued in September when skip hoisting was started, and the new system has since been handling the entire production of mine and custom ore.

A thorough system of ventilating the mine workings was inaugurated. Two 100,000-cu.ft. per min. fans were installed, one on the east side of the Kingdon shaft and one on the west side at the "C" shaft. By means of ventilation doors in the drifts the cool air is forced through the stopes and workings before finally passing up to surface through the up-cast shaft.

In the United Globe end of the mine, development during the year continued gratifying. The Kingdon shaft was sunk to the 1400, and during 1914 it is hoped to extend it to the 1600. The Grey shaft was sunk 300 ft. to the 1200 level of the Old Dominion and prospecting is now proceeding east on that level from the Grey shaft.

On surface the capacity of the old custom ore bins was more than doubled, and a conveyor-belt system installed to handle the custom ore direct into the crushing plant. Besides the complete installation of the new crusher plant and sampling mill, which were completed during the year, several additions to the machinery in the plant were made. Views of concentrator and sampling mill were published in "Photographs from the Field" pages of the JOURNAL, Dec. 6, 1913. Among them may be mentioned a new cross-compound, geared, hoisting engine at the "A" shaft, a new condenser system, turbine and 5000-cu.ft. air compressor in the smelter power house. In the concentrating department the tonnage was reduced during three or four months of the year on account of the addition to the concentrator. The installation of a new Hardinge mill, however, has now brought the crushing capacity up to normal and 500 tons are being put through the concentrator daily. The steel and corrugated work on the new concentrator addition is now complete, but owing to experimental work it is not anticipated that it will be in commission before the early spring. It is reported that Minerals Separation process is to be tried out in one section of the concentrator.

In the smelting and converting department no radical changes or improvements have been made, with the exception of the substitution of basic converting for acid converting. The first basic shell was blown in early in January, 1913, and remained on the stand until the middle of July, having made 14,500,000 lb. of copper before any patching of the shell was necessary, an excellent record in itself, considering the fact that the entire production of the plant was made with the one shell during that period. It will be put on the stand again when No. 2 shell, which is now in use and which is making a still better tonnage record, comes off.

Alaskan Railroads

WASHINGTON CORRESPONDENCE

The principal subject of interest during the past week with respect to mining developments has been the discussion of the bill for constructing a government railway in Alaska intended to open up the coal region of that territory as well as to render the copper- and gold-mining sections of the peninsula more accessible. Much of the discussion has been of a semi-political type designed to show that the failure to develop the territory by private capital was due to unreadiness on the part of certain capitalistic interests to run counter to the wishes of other interests, which obtained a strong foothold in Alaska and are in position to defend it. Another large division of the discussion has dealt with purely technical railroad questions, involving the routes that could be followed in reaching the districts that are intended to be opened up in Alaska. All of this part of the debate has been of purely technical significance. In addition, however, there has been some development of information with regard to the probable effect of the new road upon mining conditions and the circumstances under which freight is now carried and would be carried in the event of the enactment of the legislation. With reference to shipping mining machinery as things now stand, Senator Walsh made the following positive statement:

> Freight can be carried into the Tanana Valley and the Yukon Valley by two routes. You can either go across to the upper Yukon through the White Pass from Skagway to Lake Bennett and then down to Yukon, or you can transport it by ocean to St. Michaels. . . . . A combination, it was shown, has existed for years between the White Pass & Yukon R.R., which controls the steamers on the upper courses of the Yukon, and the Alaska Steamship Co. and Northern Navigation Co., which operate on the other route, so that between the two they are able to fix just such rates as they see fit in that locality. . . . . At the present time they own absolutely the Copper River R.R. That road was started by the Close Brothers, of London. The Close Brothers were the principal owners and builders of the White Pass & Yukon R.R. running from Skagway to Lake Bennett. They started to build a road up the Copper River, and having engaged in that work, they learned that the Alaska Syndicate was running a line of survey paralleling their road and they sold out to them. . . . . The Alaskan Northern R.R. was projected and the first 20 miles built by a Mr. Ballaine. Having built that distance and being unable to raise the money necessary to carry on the project further they sold out to the firm of Frost & Osborne. Frost & Osborne borrowed large sums of money for continuing the construction of this road from the Sovereign Bank of Canada known in the country in which it operated as the Morgan Bank. . . . . You will observe therefore that both of those lines are within the control of the Alaska Syndicate or associated interests. Now as to the third route, there is no line from Comptroller Bay to the Bering coal fields, but there is a projected line, the Comptroller Bay R.R., the chief factor in which is Richard S. Ryan. It is suggested that that is likewise backed and financed by the Alaska Syndicate.

Mr. Walsh alleged that under existing conditions it costs about $150 per ton to get freight to Fairbanks, whereas under the new plan with a government road it would not be over $27. This is the general drift of the argument in support of the new measure.

PERSONALS

A. E. Drucker was at Luxor, Egypt, in December last.

H. H. Johnson has returned to London from an extended visit to Canada on mining business.

S. F. Shaw, superintendent of the Tiro General mine in Mexico, is temporarily at the Horn Silver mine, Frisco, Utah.

Henry H. Armstead, President of the Armstead United Companies, sailed from Vera Cruz Jan. 8 for New York, where he will remain until the last of March, at which time he will return to Mexico.

R. S. Rainsford, general manager of the Argonaut Mining Co. of Amador County, Calif., left Jackson at the close of the trial of the Kennedy Extension-Argonaut apex suit, for a business and professional visit in New York.

It is proposed to present to the Royal Society a portrait of the retiring president, Sir Archibald Geikie, the distinguished geologist. A committee, with Sir William Ramsay as chairman, has been formed to collect subscriptions.

B. Oates, formerly with Fawcus Machine Co., of Pittsburgh, and lately with Henry Steers, Inc., New York, has accepted a position as mechanical engineer with the Morris County Crushed Stone Co., of Morristown, N. J.

Charles Fergie, general manager of the Canadian Coal & Coke Co. Ltd. has resigned to become president of the Intercolonial Coal Mining Co., of Nova Scotia. Mr. Fergie was in Nova Scotia for a number of years before he went to British Columbia.

At the recent Princeton meetings, Dr. George F. Becker, of the U. S. Geological Survey, was elected president of the Geological Society of America, and Professor A. P. Brigham, of Colgate University, was elected president of the American Society of Geographers.

Felix and John Obelander, brothers and smelter men at Murray, Utah, have started for Burma, India, where they will enter the employ of the Moha Chang Smelting & Exploration Co. Another brother, Arthur Obelander, has been in India seven years and is general manager of the smelting company.

Wm. F. Eppensteiner has resigned his position as constructing engineer at the Raritan Copper Works. He has accepted a position with Prof. A. L. Walker and will construct a new copper refinery for the Bogoslowsker Huettengesellshaft in Russia. Mr. Eppensteiner sailed for St. Petersburg recently.

Angus Cameron, president of the Radium Co. of America, Sellersville, Penn., is traveling in the West and will visit the mining sections in Colorado and Utah, where his company has interests and stations and will personally deliver parcels of radium. The policy of this company is to furnish radium to medical practitioners in the United States.

Francis S. Peabody, president of the Peabody Coal Co., of Chicago, recently gave a lecture before the College of Engineering of the University of Illinois on "The Mining and Utilization of Illinois Coal." The lecture was illustrated with excellent motion pictures taken underground. They are the first successful motion pictures so taken, and they give a vivid idea of the actual conditions met in coal mining.

OBITUARY

George A. Cox died at Toronto, Ont., Jan. 15, aged 73 years. He was a senator of the Dominion of Canada, and was one of the leading financiers of that country, having been a prominent official of a large number of financial, railway and industrial enterprises, though devoting most of his attention to the Canada Life Insurance Co. of which he was president for many years. He was a director of the Dominion Steel Corporation and the Canada Cement Co. and was at one time a director of the Crow's Nest Pass Coal Co., the pioneer coal mining company of Western Canada. Mr. Cox took an active interest in religious and philanthropic work and was liberal in his donations to such causes.

William B. Pollock, a pioneer iron manufacturer of the Mahoning Valley, and for 60 years prominent in the business development of Youngstown, Ohio, died at his home in that city Jan. 7, aged 81 years. He was born in Pittsburgh. At the age of 20 Mr. Pollock went to Youngstown, where he was employed for some years by the Brier Hill Iron & Steel Co. Deciding to engage in business for himself, he started with a small boiler shop, which has since grown to the large establishment now operated by the William B. Pollock Co. Up to about two years ago he was president of the company and was then succeeded by his son, Porter Pollock. Mr. Pollock was the builder of the first of the Eliza blast furnaces for the Jones & Laughlin Steel Co. at Pittsburgh.

J. J. Crawford died of heart failure suddenly at Berkeley, Calif., on Jan. 7, aged 67 years. The body was cremated at Oakland on Jan. 12, under the auspices of California Commandery Knights Templar. Mr. Crawford was born in Pennsylvania, and for a number of years was a resident of California. He was appointed state mineralogist in 1893 and served for four years. He issued the twelfth and thirteenth general reports published by the bureau. He was the third appointee to the position, being preceded by William Irelan, Jr., and Henry H. Hanks, and was succeeded by A. S. Cooper. Mr. Crawford, after leaving the mining bureau, was superintendent of the Gwin mine in Calaveras County. Subsequently he practiced mining engineering with offices in San Francisco.

SOCIETIES

Association of Engineering Societies—Joseph W. Peters has assumed the position of secretary of the board of managers, with offices at 3817 Olive Street, St. Louis, Mo., at which place the "Journal of the Association of Engineering Societies" is to be published.

University of Washington—The short session for mining men at the College of Mines, Seattle, Wash., opened Jan. 5 with a registration of 44 mining men from 10 states, Alaska, and five foreign countries. The course lasts three months, and is arranged in sections for quartz, placer and coal miners.

American Pig Iron Association—The officers of this association, recently organized, are as follows: President, Joseph G. Butler Jr., Youngstown, Ohio. Vice-presidents, Chicago district, M. Cochrane Armour, Iroquois Iron Co. Central district, Joseph H. Frantz, Columbus Iron & Steel Co. Buffalo district, W. A. Rogers, Rogers, Brown & Co. Philadelphia district, John B. Newton, Virginia Iron, Coal & Coke Co. Treasurer, Frank B. Richards, M. A. Hanna & Co., Cleveland. General Secretary, John A. Penton, Cleveland, Ohio. The vice-president for the Southern district was to be elected later.

American Institute of Mining Engineers—At a meeting of the Colorado Section in Denver, Jan. 17, the following officers were chosen: Chairman, Frank G. Bulkley; Vice-Chairman, S. A. Ionides; directors, David G. Miller and James M. McClave; secretary and treasurer, C. L. Colburn. A discussion followed concerning the proposed government policy of withdrawing from entry lands showing deposits of uranium, vanadium, etc. The sense of the meeting expressed was that more frequent meetings should be called. A. A. Blow called attention to the need of greater coöperation between the older members of the profession and the younger mining engineers.

University of Illinois—At a recent meeting of the board of trustees, R. Y. Williams was appointed director of the Miners' and Mechanics' institutes, which are to be established under the direction of the Department of Mining Engineering. Authority for the establishment of these institutes was granted by an act of the State Legislature in 1911, but no appropriation was made to carry out the authorization until the recent session of the Legislature, at which time an appropriation of $15,000 per annum was made. The purpose of the Miners' and Mechanics' institutes is somewhat similar to that of the Farmer's institutes, but their specific purpose is to assist men who are preparing themselves to pass the tests required by the State before they can hold official poitions about the mines. Mr. Williams was in charge of mines in West Virginia for some time and since 1908 has been stationed in Urbana as mining engineer for the U. S. Bureau of Mines.

American Iron & Steel Institute—Action to increase the membership limit from 1000 to 1500 was taken at the regular meeting of the directors of the organization, held at New York, Jan. 9. This increase was provided for by the adoption of an amendment to the by-laws raising the active membership from 1000 to 1250 and by the creation of an associate membership to be limited to 250. To establish the associate membership, an amendment of the constitution was adopted by the directors, which is subject to ratification by the general organization. A call has gone out for a general meeting, at which this ratification is expected to be given.

This meeting will vote by proxy. The dates of May 22 and 23 were fixed upon for the annual New York meeting. The general committee on arrangements appointed consists of six resident directors and is composed of the following: James A. Farrell, chairman; E. A. S. Clarke, John A. Topping, Charles M. Schwab, F. S. Witherbee and J. C. Maben.

Rensselaer Polytechnic Institute—The institute is about to celebrate its 90th birthday, and the Alumni of this oldest of the American technical schools propose that one of the features of this anniversary shall take the form of a tribute to the engineering profession. With this in view a dinner will be held in Biltmore Hotel, New York, on Friday evening, Feb. 6, 1914, at which the guests of honor will be the presidents of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Institute of Mining Engineers and the Society of Naval Architects and Marine Engineers, and other distinguished engineers and representative men identified with engineering development. The addresses will be by men of national reputation, who can speak with authority upon the value of engineering service and upon the opportunities, responsibilities and obligations of engineers in this era of progress and development. While this dinner is being arranged by the graduates of the Rensselaer Polytechnic Institute, it is believed that members of the engineering societies mentioned above will be glad of an opportunity to join in this act of appreciation of engineers and engineering. They are cordially invited to take part in this tribute.

INDUSTRIAL NEWS

The C & C Electric & Manufacturing Co. announces that it has appointed F. A. Saylor, with offices in the Greenwood Building, Sixth and Vine Sts., Cincinnati, Ohio, as agent for the southern part of the state of Ohio.

The C & C Electric & Manufacturing Co. announces that it has discontinued its Pittsburgh office, in charge of Ludwig Hommel & Co., and this territory will now be taken care of by its Philadelphia manager, J. C. Chamberlin.

S. Wolff, formerly manager of the Cleveland office of the Allis-Chalmers Manufacturing Co., has been appointed Chicago manager for the De Laval Steam Turbine Co., manufacturers of steam turbines, centrifugal pumps, centrifugal air compressors, speed reducing gears, etc., with offices in the Peoples Gas Building, Chicago.

TRADE CATALOGS

Buff & Buff Mfg. Co., Jamaica Plain, Boston, Mass. Booklet. The Buff transit. 32 pp., illus., 4x6 inches.

W. S. Rockwell Co., 50 Church St., New York. Bulletin No. 20. Heating furnaces. 16 pp., illus., 8½x11 inches.

Ingersoll-Rand Co., 11 Broadway, New York. Booklet. Imperial air compressors. 20 pp., illus., 6x9 inches.

Chicago Pneumatic Tool Co., Fisher Building, Chicago, Ill. Bulletin No. 149. Portable mine hoist. 8 pp. Illustrated, 6x9 inches.

The new edition of the Simplex Manual, published by the Simplex Wire & Cable Company, Boston, is ready for free distribution. It gives information of all sorts about insulated conductors and other electrical matters.

Sullivan Machinery Co., Chicago, Ill., Bulletin No. 58—P. Sullivan Single-Stage Power Driven Air Compressors. 20 pp. Illus., 6x9 in. Bulletin 58—S. Sullivan Angle Compound Power Driven Air Compressors. 20 pp. Illus., 6x9 in.

New York Engineering Co., 2 Rector St., New York. Empire prospecting Drill. 48 pp., illus., 7x10 inches.

This pamphlet contains an elaborate and interesting description of the Empire drill, which has attained wide use during the last few years in the prospecting of placer deposits. That these drills have attained world-wide use is indicated in the illustrations which show views of Empire drills at work in such countries as Brazil, Colombia, Chosen and Siberia. The catalog contains many interesting suggestions regarding the use of the drills, and also brief descriptions of the Junior Empire drills, and of the hydraulic elevators and gold dredges built by this company.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

CONCENTRATION—Improvements in or Relating to the Concentration of Ores. H. W. Greenway, Prahan, Victoria. (Brit. No. 11,471 of 1913.)

CONCENTRATOR—Dry Ore Concentrator. William Winnie and James E. Seeley, Los Angeles, Calif. (U. S. No. 1,083,172; Dec. 30, 1913.)

CRUSHING—Improvements in Pneumatic Stamps for Crushing Ore and the Like. J. M. and J. L. Holman, Camborne, Eng. (Brit. No. 28,116 of 1912.)

CYANIDING—Agitator. Frank E. Marcy, Salt Lake City, Utah, assignor, by mesne assignments, to Allis-Chalmers Manufacturing Co. (U. S. No. 1,082,431; Dec. 23, 1913.)

CYANIDING—Treating Metal-Carrying Ores. Isidor Kitsee, Philadelphia, Penn. (U. S. No. 1,082,596; Dec. 30, 1913.)

DESULPHURIZING—Process of Desulphurizing and Briquetting Ores. William A. Hall, New York, N. Y. (U. S. No. 1,083,252; Dec. 30, 1913.)

DRILL. Christopher Lorrance Anton, Monongahela, Penn. (U. S. No. 1,082,617; Dec. 30, 1913.)

DRILL CHUCK—Chuck for Rock Drills. James C. H. Vaught, Globe, Ariz. (U. S. No. 1,083,310; Jan. 6, 1914.)

DRILLS—Improvements in Drills for Rock Drilling. T. Glendenning, H. W. Clayden and E. S. Stephens, Maraisburg, Transvaal. (Brit. No. 28,385 of 1912.)

ELECTRIC FURNACE—Inclosed Electric Furnace with Upper Charging Chutes. Helfenstein Elektro-Ofen-Gesellschaft M. b. H, Vienna, Austria. (Brit. No. 9590 of 1913.)

ELECTRIC-FURNACE ELECTRODES. Improvements in and Relating to Electrodes for Electric Furnaces. Friedrich Krupp Akt., Essen, Germany. (Brit. No. 17,925 of 1913.)

ELECTRIC FURNACES, Improvements in. E. Stassano, Turin, Italy. (Brit. Nos. 22,723 and 22,724 of 1913.)

EXTRACTION—Improvements in and Relating to the Extraction of Metals. G. L. Fogler, Pittsburgh, Penn. (Brit. No. 18,508 of 1912.)

FLUE DUST AND FINES—Process of Mixing Minerals and Metals with Molten Metal. Samuel L. Boggs, Pittsburgh, Penn. (U. S. No. 1,083,724, Jan. 6, 1914.)

FURNACE—Metallurgical Furnace. Leonard A. Smallwood, Birmingham, England; Alfred Smallwood administrator of said Leonard A. Smallwood, deceased. (U. S. No. 1,082,828; Dec. 30, 1913.)

GAS-CLEANING MECHANISM. Nicholas F. Egler, South Chicago, Ill., assignor to The Blair Engineering Co., Chicago, Ill. (U. S. No. 1,083,068; Dec. 30, 1913.)

GASOMETER FOR AMMONIA CYANIDE PROCESS—Means for the Maintenance of Gas in Confinement. S. E. Bretherton, Berkeley, Calif. (U. S. No. 1,082,797; Dec. 30, 1913.)

IRON—Improvements in or Relating to the Purification or Extraction of Iron. G. H. Benjamin, New York. (Brit. No. 27,968 of 1912.)

LIXIVIATION—Improvements in and Relating to Lixiviating Apparatus for Ores and Other Material. C. Robinson, Mount Vernon, N. Y. (Brit. No. 2805 of 1913.)

MINE LOCOMOTIVE. William F. Eckert and William C. Whitcomb, Rochelle, Ill. (U. S. No. 1,082,740; Dec. 30, 1913.)

OIL—Method of Extracting Oil from Oil-Bearing Rock or Sand. Roswell H. Johnson, Pittsburgh, Penn. (U. S. No. 1,083,018; Dec. 30, 1913.)

ORE TREATMENT—Improvements in or Relating to a Process for the Treatment of Sulphuretted, Oxidized, Carbonated and Other Ores. N. H. M. Dekker, Paris, France. (Brit. No. 28,857 of 1912.)

ORE TREATMENT—Improvements in or Relating to the Treatment of Ores. S. L. Bensusan, London, Eng. (Brit. No. 26,350 of 1912.)

POTASSIUM AND SODIUM COMPOUNDS—Process for Producing Soluble Potassium or Sodium Compounds Out of Feldspar or Mica or the Like. Axel Rudolf Lindblad, Ludvika, Sweden. (U. S. No. 1,083,287; Jan. 6, 1914.)

SEPARATOR—Ore Separator. Albert E. Bookwalter and Max A. Dorland, Coeur d'Alene, Idaho. (U. S. No. 1,083,481; Jan. 6, 1914.)

SEPARATORS—Improvements in Rotary Magnetic Separators. Firm Maschinenbau-Anstalt Humboldt, Coln-Kalk, Germany. (Brit. No. 11,430 of 1913.)

SMELTER SMOKE—Fume Arrester. Selden Irwin Clawson, Salt Lake City, Utah. (U. S. No. 1,083,057; Dec. 30, 1913.)

SULPHUR—Process for Extracting Sulphur. William A. Hall, New York, N. Y. (U. S. No. 1,083,253; Dec. 30, 1913.)

TUNGSTEN—Method of Treating Tungsten Ores. Frederick M. Becket, Niagara Falls, N. Y., assignor to Electro Metallurgical Co., Niagara Falls, N. Y. (U. S. No. 1,081,571; Dec. 16, 1913.)

TUNGSTEN—Process of Treating Tungsten Ores. Frederick M. Becket, Niagara Falls, N. Y., assignor to Electro Metallurgical Co., New York, N. Y. (U. S. No. 1,081,566; Dec. 16, 1913.)

TUNNELING MACHINE. Herman H. Born and Henry A. Recen, Denver, Colo., assignors, by direct and mesne assignments, of one-sixth to said Recen, one-sixth to Phillip A. Peregrine, and two-thirds to Frank V. Goetz, Denver, Colo. (U. S. No. 1,081,524; Dec. 16, 1913.)

ZINC RETORTS—Improvements in or Relating to Vertical Zinc Retorts. A. Roitzheim, Duisburg-Ruhrort, Germany. (Brit. No. 9314 of 1913.)

Editorial Correspondence

SAN FRANCISCO—Jan. 14

A Large Supply of Water for Mining Purposes is reasonably assured, as snow fell in the high Sierra and some of the foothill sections, accompanied by heavy rains in the lower elevations and valleys, over the entire northern half of California at the close of the first half of January.

Denial of An Oil Purchase Rumor to the effect that the Shell-Royal Dutch contemplated purchasing shares of Associated Oil Co. stock from the Southern Pacific is reported to have been made by the American Gasoline Co., a subsidiary of the Shells, at San Francisco. The representative is said to have declared that the Shells would not take the Associated even if they could purchase at a low figure. The California newspapers have been insistent in the declaration that this deal was pending ever since the Shells came into California. A like denial was made by the Pacific Coast Oil Co. at a time when the negotiations for its absorption by the Standard were nearing consummation. No one seems to doubt that the Southern Pacific would be willing to sell, and get out of the oil-producing business; and no one would grieve over it.

Interest on Natomas Consolidated Bonds for January (first- and second-mortgage bonds) amounting to $525,000 is reported to have been assured by the English syndicate which is prepared to advance $3,000,000 to take up the floating indebtedness of the corporation and to cultivate the land reclaimed in the gold-dredging fields of the corporation in the Sacramento valley. It is stated that there is no question as to the ability of Natomas to carry all charges. The surplus for 1913, it is said, will exceed $300,000. The corporation has 10 gold dredges operating in American River and three in Feather River district. There are three rock-crushing plants. A new townsite has been established between Sacramento and Folsom, named Citrus, situated in the center of a large area of agricultural lands and adjoining lands now being dredged. It is not unlikely that business of this portion of the Sacramento valley lying east of American River and midway between Sacramento and Folsom will in the near future be transacted at the new town. It is not an improbable conjecture that the town of Folsom, one of the earliest placer mining camps in the state, will yet be dug up by gold dredges and the uneven contour reduced to a level plain and reclaimed to agriculture.

BUTTE—Jan. 14

Extension of Milwaukee R.R. Electrification from Three Forks to Harlowtown, Mont., will be made immediately after the first unit from Three Forks to Deer Lodge is completed. The two units are of about equal length, 114 miles. Later the line from Deer Lodge to Avery, Idaho, a distance of 211 miles, will be electrified, and eventually the entire western end of the Chicago, Milwaukee & St. Paul R.R. system to Seattle. For the electrification planned it is stated that 143,000,000 lb. of copper wire will be required, in addition to the copper that will be used in the equipment of hydro-electric power plants now under construction. Work on the first unit will begin as soon as spring weather permits.

DENVER—Jan. 17

Coal Was of Special Interest in Denver for the last few weeks of December. Throughout the autumn, the strike conditions in the coal fields created much anxiety, with the inevitable scarcity of coal and increase in price to consumers. But when the unprecedented snowstorms completely overwhelmed the city of Denver, a real coal famine set in. When fuel was needed far more than ever before, everybody was powerless to deliver it, for the streets were blockaded. The Denver City Tramway Co. performed splendid work in reopening its lines. The fall of snow was both deep and heavy. It packed down tight and had to be dislodged from the tracks with ordinary farm plows. Thousands of men with shovels followed the plows and piled up the snow on the roads between the car tracks and the sidewalks until it was 10 ft. high. The clearing out of these many miles of car tracks provided a chance for wagons, but it hopelessly obstructed all portions of the roads intended for wagon and auto traffic. The streets without car lines were gradually oened, but the snow was still deep and wheels of little service. Residents not close to car lines suffered for coal, while even the more fortunate ones were obliged to economize. Every able-bodied man in the city had an opportunity to make $2.50 per day shoveling snow, while in emergencies such as removing snow from high roofs, the pay was 75c. per hour. One main reason for the coal famine was the shortage of horses and available wagons, for practically every such outfit to be had was engaged by the city in hauling snow from the downtown streets. So profitable was this industry for the owners of teams that they could not be induced to relinquish it and take up coal hauling with its heavy, dirty labor. Finally, however, the mayor took a hand in this matter. Taken all together, the labor troubles, the railroad blockades, the city blockade, and the shortage of teams, the Denverite had experiences of the wintry variety that he hopes nevermore to repeat.

CALUMET—Jan. 17

Grand-Jury Indictments have been brought against 38 officers of the Western Federation of Miners for conspiracy by the Houghton County grand jury. C. H. Moyer, president of the federation, together with Vice-president Mahoney, Miller, Lowney and Tersich of the executive board, have been named in the indictments and nearly all of the outside organizers and local officials of the union. All of the indicted men in the district have been arrested and placed under $1000 bonds, but practically all of the outside men have left the district. President Moyer left almost immediately after Governor Ferris' recent visit. Quietness for the last week was broken only by a slight clash between the mounted police of Keweenaw County and the strikers of the Ahmeek location. The strikers had assembled at the union store at the time the workmen were returning from the Ahmeek mine, and refused to obey the sheriff's order to disperse, resulting in the calling out of the mounted police and the arrest of 24 men for violation of the injunction. The last state troops were withdrawn from Keweenaw County, Jan. 12, and the entire district is now in the hands of the civil authorities. One lot of 253 imported men was brought in last week for the mines in the north end of the district, and the men are coming in groups of their own accord seeking work in the various mines. It will be but a short time when all the men needed to put the mines back to their normal capacity will have been obtained.

ISHPEMING—Jan. 17

Western Federation of Miners Has Been Defeated in its attempt to take from the Ishpeming union a store building and $1500 in cash on deposit in bank. The effort was made because of the subordinate body's withdrawal from the organization on account, it is claimed, of too frequent assessments on the membership. A charter provision in small type and not noticed at the time provided that in cases of the kind the property of the seceding organization should go to the federation. Circuit Judge R. C. Flannigan, at Marquette, took the case from the jury, holding there was no cause for action.

An Attempt to Procure a Tonnage Tax on iron and copper ore by use of the initiative is to be made by the Michigan state grange. The outlook is not regarded with pleasure by the mining men. The mining interests are opposed to the tonnage tax because they are convinced it is not practicable and they are particularly opposed to the tonnage tax by initiative because they regard it as practically certain that any measure covering the subject enacted into law by popular vote will be drawn with little knowledge of the matter and will inevitably work out inequitable results for many of the operating companies. They contend that any simple rule of tonnage tax applied to the mines is sure to result unfairly in many cases, because practically every mine presents a different problem. On the other hand, a tonnage tax drawn on lines that would provide for the equitable taxation of all mines would be so cumbersome, and would require such intricate machinery for the determination of the rate that should apply to each property, that it would be impracticable. Since the state tax commission has begun to make real progress with the application of the ad valorem system to the mines and it is now obtaining more equitable results than ever before, it is argued further that little excuse now exists

for forcing the tonnage tax issue on the attention of the state. The experts connected with the tax commission better understand the problems that mine taxation involves, and the present valuations, taking account, as they do, of all forms of property owned by the mining companies, are the most comprehensive ever placed on the rolls. The mining interests will await the preparation of the grange bill before taking formal cognizance of the situation. Then, it is expected the grange proposition will be analyzed closely with a view of showing how inequitably it would work out if applied to different operating mines. A tonnage tax is opposed by many of the newspapers of the state. Nevertheless it appears wholly probable that the attempt of the grange to procure the adoption of the scheme by direct legislation will be successful, particularly as much feeling has been aroused in consequence of the labor strike in the copper region. It also appears wholly probable that an enactment of the kind would be followed by much litigation.

NEGAUNEE—Jan. 17

A Shortage of Timber has been experienced by some of the mines on the Michigan ranges, because of lack of snow in the woods, which had prevented the hauling of logs. In several instances much inconvenience was caused. There is sufficient snow now and the delayed timber movement is in progress. Most of the mines, particularly the hematite mines, require a great quantity of timber, and usually a year's supply is stocked at the shafts during the winter. That procured a year ago had been well depleted prior to the timely arrival of snow. A slight cut in wages has, it is reported from Manistique, Mich., been made by the Lake Superior Iron & Chemical Co., manufacturer of charcoal iron and chemicals. The reduction is ascribed to depressed trade conditions.

MARQUETTE—Jan. 17

Diamond Drilling in Chile is to be done by a man from Negaunee, on the Marquette range, who has been engaged by the Standard Diamond Drilling Co., of Chicago, and who is on his way to South America. Drilling will be done in the Coquimbo district. It is in this region that the Bethlehem Steel Co. controls enormous deposits of iron ore and it is surmised that the Negaunee man will be employed in the further exploration of these deposits.

SILVER CITY—Jan. 12

Gold and Silver from Mogollon make up the greater portion of the precious metal production of New Mexico, and it is predicted that during 1914 the output will be doubled. Several new auto trucks have been added to the already large list, necessitated by the demand for supplies. Owing to the inclement weather it took one of the most powerful auto trucks now operating between Silver City and Mogollon, one week to make the round trip. One of the large companies was entirely out of lead acetate, and was preparing to close down when the truck arrived. A meeting was recently held at Mogollon to effect a settlement of freight rates which the freighters have declared were causing them a loss, but no strike developed as was reported. Good-road enthusiasts in the Silver City and Mogollon districts are trying their best to bring the Mogollon road into the limelight in an effort to have highway rebuilt or repaired.

FAIRBANKS, ALASKA—Jan. 1

The Output of the Fairbanks District, according to figures prepared by the local office of the Wells Fargo Express Co., for the year 1913 will be practically $1,000,000 less than it was a year ago. The causes for this are various and hard to be determined, but many of the prominent men of the district attribute it in great part to the shortage of water during the last summer. The Hot Springs district production fell from $500,000 last year to about half that amount this year, and the production from many of the creeks about Fairbanks fell off proportionately. The following is the list of shipments of bullion for the year 1913 to date as prepared by Frank Cook, agent of the Wells Fargo Express Co.: Fairbanks district, $3,469,321; Hot Springs district, $215,579; Ruby district, $70,585; total, $3,755,485. The output of the Tanana valley since its discovery according to the figures from the same source is as follows: 1903, $60,000; 1904, $400,000; 1905, $5,000,000; 1906, $8,000,000; 1907, $9,000,000; 1908, $10,000,000; 1909, $10,500,000; 1910, $6,000,000; 1911, $5,500,000; 1912, $5,000,000; 1913, $4,000,000; total, $63,460,000.

SOUTH PORCUPINE—Jan. 17

The Property, Formerly Known as the Vipond, is still under consideration by several companies and if a satisfactory price can be arrived at, it is probable that the property will change hands. The West Australian Gold Mines Co., which recently purchased the North Thompson, is understood to be still negotiating for the property, as is also the Crown Reserve. This latter company had an option on the Vipond, good until Dec. 1, but as the examination did not disclose the tonnage of ore that was anticipated, the option was allowed to lapse. The Crown Reserve is, however, anxious to get the property to supplement the tonnage in the McEnaney, which is comparatively small although rich. The idea would be to utilize the Vipond mill to grind the ore and pump the pulp through a pipe line to the McEnaney cyanide plant, the capacity of which is in excess of the company's present requirements.

TORONTO—Jan. 17

California Exploration Co., it was recently announced, would absorb the Northern Ontario Exploration Co. and this has occasioned much criticism by Canadian shareholders. Considerable doubt exists as to the amount of cash in the treasury of the Northern Ontario company and as to the proportion of the expense of developing the Plymouth mine for the California Exploration Co. that was borne by the Northern Ontario company. Shareholders of the latter company appear to have had no knowledge of the fact that their money was being used to develop the Plymouth mine, nor do they seem to know much about the disposition of the rest of the California company's stock.

Stock Offering to Employees of the International Nickel Co., operating the Copper Cliff nickel mines, at less than market prices purchasing on the installment plan, is the announced intention of the company. Every officer and employee will be permitted to subscribe for a specified number of shares at $110 per share, which is somewhat less than the present market price. The stock can be paid for in installments and in addition, there are other benefits contingent upon continuous service with the company. This plan is somewhat similar to that in force with the U. S. Steel Corporation and other large industries in the United States, but it is the first time that it has been tried by any company operating in Canada.

The Merits of Peat as a Fuel have been investigated by the department of mines at Ottawa, which has recently concluded its exhaustive work, done to determine whether peat could be manufactured at a reasonable price and whether there was a sufficient supply in Canada to justify operations. A peat plant was built at Alfred, Ontario, and the officials in charge reported that any amount of peat fuel could be manufactured and placed on the market at $2 per ton, one ton of peat being equivalent to half a ton of soft coal. One of the greatest difficulties experienced, however, was in drying the peat as artificial drying was too expensive and drying in the open air subject to many inconveniences. Recent discoveries in several countries in Europe in connection with the possibilities of peat as fuel have convinced the government that a further and more comprehensive investigation into the possibilities of peat manufacture in Canada is advisable. This work will be undertaken as soon as possible and the government will give every encouragement to legitimate peat manufacturing enterprises.

Extension of Industrial Disputes Act to embrace the most advanced legislation for the prevention of industrial warfare known to any country is the intention of the Dominion government. The act which at present affects only those men engaged in work in any public utility, is to be extended to take in all branches of labor, public and private. The chief purpose of this act, as at present constituted, is to prevent strikes and lockouts until the matter of the dispute has been considered by a board of conciliation and arbitration, and a finding arrived at by the board. Neither employers nor employees are bound to abide by the decision of the board, but the result has been that examination of the case by the board has effected many harmonious agreements and has reduced the number of strikes and lockouts in the Dominion. The Minister of Labor feels that much good can be accomplished by extending the scope of the act to include all labor. Private enterprises from the point of view of both employer and workmen will be conducted under the eye of the department and in case of dispute there can be no strike or lockout until a board of arbitration has considered the case and made its report. An important point in this proposed legislation will be that no employer will be allowed to dismiss or refuse to employ a man on the ground that he is a member of a labor union nor will union men be allowed to refuse to work with an employee on the ground that he is not a union man. Employers and employees who do not live up to these clauses will be subject to severe penalties. It is believed that this proposed legislation will be bitterly opposed by the labor unions.

The Mining News

ALABAMA

Jefferson County

LOCAL HEARING IN U. S. STEEL SUIT before a Federal examiner was ended Jan. 13. Testimony presented tended to show that no harm had been done other companies in district by absorption of Tennessee Coal, Iron & R.R. Co. James Bowron, president of Gulf States Steel Corporation, testifying in suit stated that Southern Steel Co. had decided to relinquish ownership of Trussville furnaces to bondholders of Lacey Buck Iron Co.

DAVIS CREEK COAL & COKE CO.—Explosion of gas in Rock Castle mine, 29 miles from Tuscaloosa, caused death of 12 men.

REPUBLIC IRON & STEEL CO. (Raimund)—Company is building brick change house at its red ore mines. A feature will be two swimming tanks, one for white and one for colored employees.

WOODWARD IRON CO. (Birmingham)—Vanderbilt furnaces will be abandoned when they become unprofitable and no more will be built within the city. Between $700,000 and $1,000,000 will be spent on construction at Woodward, including 30 byproduct coke ovens. This will make 155 of Koppers type. A coal washer and later on a steel plant will be built. American Creosoting Co. will also build a plant at Woodward having a capacity of 6,000,000 gal. of tar per month. Estimated cost, $250,000.

ALASKA

PROTESTS AGAINST MINING LAW passed by territorial legislature are being made by miners of Chisana district. Some say that 90 days is not enough for prospector to stake a claim and bring in an outfit to remote regions. Chisana prospectors are petitioning for an extension of time; however, legislature will not meet again for many months.

TANANA OUTPUT FOR 1913 was practically $4,000,000 despite long season when district was without water. On Dome Creek, operations were hampered by lack of water, and this was responsible, in part, for falling off of about $2000 in production as compared with 1912. Considerable prospecting is being done. Output of Hot Springs district has fallen off considerably but all large operators were compelled to shut down for a considerable time on account of water conditions. Tenderfoot, Salchaket, Kantishna and Bonnifield districts are being prospected thoroughly and new discoveries are being reported from time to time. Of particular interest is rapid increase in output of gold from quartz mines.

ALASKA GASTINEAU MINING CO. (Juneau)—A special single-drum electric hoist has been purchased from Denver Engineering Works Co. Hoist is to be driven by a 40-hp. a.c. electric motor and will have a gear combination that will enable the hoist to operate at a rope pull of 15,000 lb. at 40 ft. per min. and 4000 lb. at 240 ft. per min. Hoist will be equipped with herringbone gears and a silent chain drive from motor.

ARIZONA

Gila County

INSPIRATION CONSOLIDATED (Miami)—First ore was put into the new test mill, Jan. 12, and since following Tuesday mill has been working three shifts. All ore is now being hoisted at Scorpion shaft, put through crusher and loaded direct to dump cars for transportation to test mill. However, work will be started within a few days on incline conveyor belt from Scorpion crushing plant to east end of ore storage bins, and ore will then be stored in a compartment of bins, as at present there is no reserve ore for operation of mill in case of a breakdown of Scorpion hoist. A recent assay of the tailings from the oil flotation process showed greatest amount retained in tailings was 0.64%, while lowest was 0.13%. Towers of Roosevelt power line are now visible from millsite, but it will probably be several months before wire is strung and current furnished. Grading continues for smelter, and railroad is now up to site and Superintendent L. R. Wallace expects soon to open an office on grounds, accounts now being handled through the office of Inspiration company. With only a small amount of riveting necessary to complete erection of sampling mill and ore bins, American Bridge Co. has moved its large crane, all tools and practically all the force to millsite and is rapidly installing a steam traveler in the concentrator. Three cars of steel for the building have already arrived and been unloaded, while two more cars are on road. All steel framework for incline convevor is now in place, and this as well as coarse-crushing plant building is now in shape for riveting.

Graham County

TWIN PEAKS MINING & MILLING CO. (York)—Erection of a 50-ton concentrator and cyanide plant of combination type of sand leaching and slime treatment in Parral agitating tanks, has been started. Machinery for mill concentrator and power plant was received late in December. El Paso Foundry & Machinery Co. was awarded contract for cyanide machinery. It is expected to have plant in operation about Mar. 1. Ore in sight justifies present plant of 50 tons capacity, and capacity of mill can be increased later if found advisable.

Greenlee County

CARLYLE (Duncan)—This property 18 miles from Duncan and eight miles from Twin Peaks mine, is to be extensively operated by Beam Bros., of Wilkes-Barre, Penn. Considerable new mining machinery has been delivered and 60 men are at work. Recently a carload of ore was shipped from a new find to El Paso smelting plant and was basis for renewed activity.

Maricopa County

A CINNABAR PROPERTY ON SYCAMORE CREEK, out from Phœnix, will probably be equipped with a Scott furnace. Freight teams will leave Phœnix soon with several wagonloads of firebrick. Pipe retort which was recently built on property of Sunflower Cinnabar Mining Co., has been dismantled.

RED ROVER (Phœnix)—Wagon road, which was washed out some time ago by a cloudburst has been repaired and development of property is under way.

Mohave County

C. O. D. (Kingman)—Work of unwatering shaft and clearing away débris has been completed and sinking commenced; 40 ft. of sinking will be necessary to connect with 300-ft. level.

Pinal County

KELVIN-SULTANA (Kelvin)—New hoisting cables of larger diameter have been placed on double-drum, electric hoist at Westfall shaft. Old cables will be used in constructing a foot bridge across Gila River. New tramway is in operation and at try-out proved capable of delivering in excess of six tons per hour. No. 1 winze from 300-ft. level is down 60-ft. in a 6-ft. shoot of 5% copper ore. New bunk house is being built for use of white men employed in shaft work.

Yavapai County

GOLDSWORTHY PLACER (Lynx Creek)—Property has been bonded to G. O. Smith, W. L. Alexander and W. Blount, who are equipping it with machinery for sluicing.

CENTRAL EUREKA (Sutter Creek)—Ore disclosed lately in winze on 3100-ft. level is reported to be 14 ft. wide carrying some bonanza ore. Vein is high grade for entire width.

HUMBOLDT SMELTER (Humboldt)—It is probable that in near future treatment of custom ores will be resumed. For some time now plant has been treating only ores from Bluebell mine. All custom ores from district have been shipped to Douglas.

NELSON (Crown King)—Large tonnage of mill ore having been developed recently it has been decided to construct a narrow gage railway to connect with Bradshaw Mountain branch of Santa Fé, Prescott & Phœnix Ry. It is reported that a 20-stamp mill will be built near mines.

CALIFORNIA

Alameda County

SWINDELL (Livermore)—Operation of magnesite mine on Cedar Mountain, which has been idle for a year, has been resumed. Oil fuel is used.

WAGNER (Coffee Creek)—P. H. Wagner and others, of Berkeley are developing this quartz mine, and contemplate building a new stamp mill.

Amador County

IN KENNEDY EXTENSION VS. ARGONAUT SUIT argument by attorneys before Judge F. V. Wood in the Superior Court was begun on Jan. 8 and concluded Jan. 10. Proceeding was interesting only to auditors who are inclined to be entertained by eloquence of attorneys, or to those that had not heard the evidence. Court has 60 days under statute in which to deliver decision, which provides for suspension of salary if decisions are delayed beyond specified time.

PLYMOUTH CONSOLIDATED (Plymouth)—Plans are being drawn for a new milling plant of 300 tons capacity. Plans are not completed. Installation may include both stamps and Hardinge mills.

KENNEDY (Jackson)—Installation of four tailing wheels and electric motors for driving them was completed and one of the wheels was turned on Jan. 10 to test construction. Some minor mechanical details are to be corrected. Practical and economical handling and conveying of tailings from mill to gulch on company land and assurance of regular operation will be demonstrated as soon as minor corrections are made.

ZEILA (Jackson)—A small amount of ore is being milled, with five to 20 stamps of 40-stamp mill dropping as extraction of ore may require. It was expected that mine and mill would be closed down at end of year unless a sale of property was satisfactorily negotiated. There is no doubt that mine is for sale and present continued operation is due to finding of some new ore and to possible securing of a purchaser on terms satisfactory to owners. It is understood that only terms obtainable would be an option of purchase. Possibility of a working bond is said to be out of question. It is not improbable that high rates of insurance under compensation act have had an effect upon owners in determining not to explore the ground below 1500-ft. level and install a new plant. It is conceded that property is well worth exploration and improved surface plant. But owners seem disinclined to take any chances, despite fact that closing down of mine would lessen prospect of a sale.

Del Norte County

ORO DEL NORTE (Crescent City)—It was expected that new plant for treating black sand for the recovery of gold and platinum would be in operation early in January. Steam power will be displaced by electric power to be generated by

a 150-hp. St. Mary gas engine using distillate fuel. Redwood was used for steam plant. Scarcity of fuel was one reason for using electricity.

Inyo County

CERRO GORDO (Keeler)—Fifteen tons of ore are being shipped daily to Utah smelters; 10 tons of this is zinc ore.

Kern County

PINMORE (Johannesburg)—Osdick & Miller, lessees, report a new orebody from which 40 tons have been hauled to Phœnix mill.

YELLOW ASTER (Randsburg)—Electric motors are being installed. Mill wiring is completed and electrically driven air compressor is ready for service.

Nevada County

UNION HILL (Nevada City)—It is reported that management is to be taken over by Henry Malloch, of San Francisco, who is manager of South Eureka, Oneida and Hardenberg in Amador County.

GOLDEN CENTER (Grass Valley)—Mine was flooded during December storm and it was necessary to remove pumps. An air-lift was installed and mine is being unwatered. New 10-stamp mill is ready.

OMEGA (Forest)—L. O. Dale, of Oakland, representing a controlling interest, has completed an examination as a basis of plans for resumption of development work. All drifts are in gravel, with a large remaining area of unexplored ground.

Sacramento County

UNION DREDGING CO. (Folsom)—It is reported that M. W. Newton and F. M. Kirby, of Philadelphia, have proposed to stockholders and creditors to take over land and dredge and resume operations. Property was promoted and the company organized by B. F. Warnick, of Philadelphia, and a 9-cu.ft. bucket-elevator Bucyrus type dredge built and put in commision, March, 1912. Ground was not thoroughly prospected, resulting in digging of unprofitable portions of holdings. Dredge was closed down last spring.

San Luis Obispo County

CARISSA CHEMICAL CO. (San Francisco)—Development and installation of machinery are contemplated at Soda Lake deposit 30 miles southwest of McKittrick.

Shasta County

GLADSTONE (French Gulch)—December storm shut off electric power furnished by Northern California Power Co. and caused the flooding of mine owing to enforced shut down of pumps. Stamp mill also had to be closed down. Principal loss will be in shortage of production for month.

BALAKLALA (Coram)—Installation of Hall desulphurizing single-unit plant is practically completed and is in trial operation. Principle has been satisfactorily demonstrated and elemental sulphur produced. There are some mechanical details that require modification. Progress of trials has so far been satisfactory.

Sierra County

TIGHTNER (Alleghany)—New deep shaft has passed 100-ft. point and is following vein in foot wall. At this level vein is over 7 ft. wide, with all quartz of milling character, although outside main payshoot. Result of recent work indicates that vein system will persist to great depth. The 20-stamp mill is running at full capacity, with most of ore coming from upper workings. Stockholders were made a New Year gift of a dividend of $500 per share. Total dividends since company began operating, 16 months ago, amount to $160,000, with an initial investment of less than $100,000. Substantial payments on purchase price of property have been made besides extensive and costly improvements, including building a new 20-stamp mill.

COLORADO

Boulder County

WHITE RAVEN (Boulder)—Mine continues to make its regular output of high-grade silver ore. Oreshoot causes much interest from fact that it is along strike of a welling of many fissures. Often silver ore, in which silver is free, known lode that eleswhere has always produced gold. Locally within this property there appears to be a complex unit-is contained in a gangue that forms crusts about rounded pebbles and small boulders of prevailing country rock, and this leads to belief held by some that this shoot is similar in origin to Bassick mine in Silver Cliff district.

Clear Creek County

SNOW FALL IN CLEAR CREEK AND GILPIN COUNTIES during first half of December, was between 4 and 5 ft. This has precluded surface prospecting for rest of winter, and development at many of small outlying properties has been handicapped.

ROSEBUD—Electric power line has been completed and Temple-Ingersoll drill will be used.

PAPPOOSE—This mine near head of Virginia Cañon has been equipped with an electric hoist and other machinery for further development. Shaft will be sunk an additional 50 ft. and bottom level will be advanced each way on vein.

LITTLE MATTIE (Idaho Springs)—This 75-ton mill in Chicago Creek operated during December with little interruption on account of storm, and accumulated a large quantity of concentrates which is now being shipped to Chamberlain sampler.

W. J. CHAMBERLAIN ORE CO. (Idaho Springs)—Sampler receives a large proportion of ore produced in Clear Creek County. During 1913 company shipped out 1288 cars of ore, representing a total of 32,200 tons, average value of which was about $25 per ton.

ARGO MILL (Idaho Springs)—Numerous repairs and improvements have been made in this plant at portal of Newhouse tunnel, for purpose of increasing recovery and reducing cost of operation. Two new 50-hp. motors have been installed in order better to operate mill on unit system.

FRENCH FLAG (Idaho Springs)—Developments last fall and winter have met with fine results. Mine is now producing two grades of ore. First-class runs about $80 per ton and is being stocked for future shipment in large tonnages. Second class averages about $25 per ton and its shipment provides for all present expenses.

DRUMMOND AND TOM MOORE MINES on Columbia Mountain are to be reopened and developed by a new company to be supported by Denver and Colorado Springs men. Adit on Tom Moore vein, which has followed a small streak of $40 ore during last 200 ft., is to be advanced along vein, and a winze is to be sunk about 500 ft. from portal of tunnel.

JACKSON MILL (Idaho Springs)—This custom mill is treating ore from Golden Edge property, which is being developed and operated through the Newhouse tunnel; from Bellman mine, which is worked through Big Five tunnel; and from Gladstone property, two miles west of Idaho Springs. Operators of Lincoln mine will commence shipping to this mill in near future.

LITTLE GIANT GOLD MINING & MILLING CO.—Company operating Little Giant-Commodore group on Red Elephant Mountain, has opened a promising new oreshoot on White vein near its junction with Shouster vein. Ore is 4 to 5 ft. wide and has an average value of $80 per ton. Company owns 300 ft. of this vein which will be opened by drifting as rapidly as possible. New ground is being systematically prospected and some old workings have been cleaned out and retimbered. It is planned to develop and operate a part of property of 72 claims through Commodore tunnel, from which connections will be made with upper workings. Early in 1914, Tabor tunnel will be equipped and advanced 800 ft. to intersect Little Giant vein at a point 300 ft. below workings from shaft.

Lake County

MT. CHAMPION MINING CO. (Leadville)—Ore is in a vein in a fault fissure between granite and trachyte, being occasionally 30 ft. thick. Along hanging wall there is a streak of from 1 to 6 ft. of smelting ore assaying upward of $75 per ton, while rest of vein will average about $12 per ton, and is treated in mill, where it is concentrated in ratio of 10 to 1. About 100 tons per day are put through mill.

San Juan Region

MAYFLOWER (Silverton)—Development of find made last summer near Silver Lake mine in Arrastre Gulch has been continued, and it has developed reserves of heavy sulphides of copper and lead assaying well in gold and silver. Entire output is being handled by burros and great difficulty is being experienced. Next summer will probably see this property equipped with its own power plant and mill.

STANDARD CHEMICAL CO.—During November this company produced 306 tons of carnotite ore, but on account of bad condition of wagon roads between mines and railroad shipping point at Placerville, only 195 tons were shipped to company's plant in Pennsylvania. Company is now employing 75 miners at mines; has 93 burros packing ore from mines to wagon road, and 125 horses and 20 men are engaged in hauling ore to Placerville.

WESTERN COLORADO POWER CO.—New flume from Trout Lake to Lake Fork pressure box at Ames Station has been completed. New flume is 13,000 ft. long and has a capacity of about 70 cu.ft. per sec. Fall from head gate to pressure box is about 60 ft. Water is delivered to power plant under a head of about 900 ft. Over 800,000 ft. of lumber was used in construction. Purpose of flume is to increase power of generating station from 2500 to 5000 horsepower.

Teller County

GOLD SOVEREIGN (Cripple Creek)—Company is sinking its main shaft on Bull Hill.

STRONG (Victor)—Strong shaft is being sunk, and has reached a depth of over 1200 feet.

GOLDEN CYCLE (Goldfield)—First dividend of year, 3c. per share, or $45,000, declared Jan. 1.

JO DANDY (Cripple Creek)—Charles Ridpath has been appointed manager to succeed the late W. S. Copeland.

VINDICATOR (Victor)—Regular quarterly dividend of 3c. per share, or $45,000, has been declared, bringing total dividend up $2,857,500.

MARY McKINNEY (Anaconda)—Regular quarterly dividend of 2c. per share amounting to $26,185 has been declared. Total dividends, $1,116,938.

COPELAND SAMPLER (Victor)—Following death of W. S. Copeland on Dec. 19 this plant has been sold. New company named Copeland Ore Sampling Co. is composed of H. C. Harris, president; H. L. Shepherd, secretary and treasurer; W. F. Van Sant, general manager, and W. W. Collins, mill superintendent.

PORTLAND (Victor)—Quarterly dividend of 2c. per share, or $60,000, declared Jan. 5, bringing total dividend up to $9,517,080. Annual stockholders' meeting will be held at Cheyenne, Wyo., Feb. 2. Sinking has been started on No. 2

IDAHO

Cœur d' Alene District

CALEDONIA (Kellogg)—Ore was cut a few weeks ago on 1000-ft. level and two rounds blasted did not cut through vein. Half is clean shipping ore and half is milling ore of good grade. Orebody was encountered in a raise from Keating tunnel. Between point where vein has just been cut and upper workings, where ore has been mined, is a body of 600 ft. of unmined ore. Finding of ore on 1000-ft. level and on 900-ft. level just prior to settling litigation between Caledonia and Bunker Hill demonstrates that dip of vein has changed and Keating tunnel will now be driven ahead to cut vein, which will give approximately 150 ft. more depth. With extension of Keating tunnel to vein Caledonia will have an orebody which can be stoped for 750 ft. up to upper workings. Rapid work is being done on incline connecting Caledonia with long Bunker Hill tunnel for hauling ore to mill which will be ready about Jan. 15.

MICHIGAN

Iron

MILLIE (Iron Mountain)—This property, which has been idle for several years, was sold at auction several weeks ago to B. J. Clergue, of Montreal, who represents Dessau company, control of which rests with Lake Superior Corporation. No information has been given out as to new owners' plans on commencing operations in near future.

NEWPORT (Ironwood)—Five-compartment shaft was put out of commission last week when a skip broke lose and jumped into adjoining compartment and then into cage road, causing considerable damage to steelwork. All hoisting through shaft had to be suspended for over a week and little ore which was mined was taken to surface through old Bonnie shaft.

MACKINAW (Gwinn)—Work of erecting a steel headframe has been completed and steel crew has been transferred to Gardner, where a similar shaft house will be put up. Both of these mines are new and have never hoisted ore, although, they will be in shipping division next season. Shafts are part way down and will soon reach a depth where crosscuts can be started to the ore.

MILWAUKEE-DAVIS (Negaunee)—This property, one of the oldest in city, was closed down lately and it is not believed that it will be operated again. Breitung interests, that operated mine last four years, did not believe there was sufficient ore left to warrant continuing work. Machinery will be removed and taken to other mines of company. All men who worked there were given employment at company's mines in Negaunee.

CLEVELAND-CLIFFS IRON CO. (Negaunee)—One of the deepest vertical diamond-drill holes ever put down in this region was completed a few weeks ago. A depth of close to 3000 ft. was attained and hole was only off a few degrees at bottom. Several years ago George Maas, of Negaunee, put down a hole 3400 ft. at Humboldt on Marquette range, but it was at an angle. Drilling in Negaunee basin is extremely difficult, formation being exceptionally hard. A large Sullivan machine was used.

NEGAUNEE (Negaunee)—A fire, which started in ninth level pump house of No. 2 shaft cost lives of one pumpman and a mining captain. There was only one man in workings when fire was detected, and he reached surface in safety. Pumpman who lost his life went into mine as soon as he heard of fire in order to see that his pumps were working. He was suffocated by smoke, and it was four days before his body was recovered. Captain John Barrett, who was also killed by gas, was endeavoring to rescue some men overcome while doing rescue work and fire fighting. He was supplied with an oxygen helmet but removed it to call for aid. Rescue crews from company's other mines were called and it required several days to get mine in shape for operations again. Almost a week's time was lost, while Maas mine, which is connected with Negaunee was closed for three days. When one of pumps stopped, bailers were put to work in No. 3 shaft to raise water, but both broke loose and dropped to sump. A large high-pressure centrifugal pump, recently taken into mine but not connected, was put in shape for use, work of installing it being done in record time. When bailers were lost water rose over 1 ft. per hour on bottom level and big pump was started when water was within 1 in. of controller box. Men worked waist-deep in water making connections, and it was a close call for lower levels of both mines. Several men were overcome and would have lost their lives if it had not been for trained rescue crews with oxygen helmets. Damage to mine from fire was slight as it was confined to a shaft, which has been abandoned. Greatest damage resulted from water, which was mastered only after two days of continuous work.

MINNESOTA

Cuyuna Range

MUNICIPALLY OWNED IRON ORE LANDS—By will of late Judge George W. Holland, prominent Cuyuna Range fee owner, Brainerd becomes possessor of two tracts of land which, while wholly unexplored, are well located for mineral. City council has advertised for bids for leasing properties.

EASTERN EXTENSIONS OF THE CUYUNA have been shown up by late drilling to east of deposits heretofore known, ore having been found at distances as great as 25 miles from present eastern boundary of the range. Recently, in Sec. 23, 48-27, Aitkin County, Olson & Berg Exploration Co. encountered considerable high-grade manganese-iron ore, some of which ran as high as 30% manganese, which is locally taken to mean a possible extension of formation in which high manganese ore of Cuyuna-Mille Lacs mine is found, which property is 18 miles westward. Other scattered drilling in Aitkin County has, here and there, shown up iron ore, but as yet no merchantable body of iron ore has been found.

OPTIMISM ON THE CUYUNA RANGE prevails despite unfavorable conditions on Mesabi and other iron ranges. Cuyuna range shows more activity and optimism than at any time in the past. Jones & Laughlin interests are acquiring leases, and are check drilling on property adjoining the Pennington pit. Armour No. 1, closed down for a considerable part of last season, is expected to resume as soon as navigation opens. Meacham mine, adjacent to town of Crosby, which mine has never produced, is said to be about to start operations. Canadian-Cuyuna Ore Co., east of Brainerd, will start shaft sinking next month. This company, allied with Canadian interests, has a five-year contract for its output with Canadian furnace interests. Soo Line and Northern Pacific Ry. are both exceedingly active. At present both lines have construction camps on North Range, and are planning additional trackage of importance.

ROWE (Riverton)—Cold weather has caused a cessation of hydraulic operations, but stripping by steam shovel continues. It is planned to ship 400,000 to 500,000 tons this season.

CUYUNA-DULUTH (Ironton)—Now sinking shaft to 300 level. Over 2000 ft. of workings have been opened and the mine is preparing to ship approximately 200,000 tons in 1914, if possible.

THOMPSON (Crosby)—Inland Steel Co. has finished new railroad approach to pit, which will save one-half mile of haulage. Good progress being made in stripping property which was formerly an underground mine.

CUYUNA CENTRAL ORE CO. (Crosby)—Recent drilling on options held by company in Sec. 27, 47-29, east of Iron Mountain mine, is said to have shown a considerable tonnage of ore, some of which is of bessemer grade. Some drilling, however, encountered ore running 15% in manganese.

CUYUNA-MILLE LACS (Crosby)—Ore is now being hoisted from first level. Due to pump troubles, second level is not producing. Now shipping manganiferous iron ore all-rail to Manistique, Mich. Mine is hoisting 250 tons daily from first level. Entire 1914 production sold.

Mesabi Range

WEED (Mesaba)—Shaft sinking was to start Jan. 5.

LA RUE (Nashwauk)—Shortly after first of new year a washing plant will be erected, to handle approximately 100,000 tons of ore next season.

OLIVER IRON MINING CO. (Aurora)—It is stated that company is about to open up its deposit on land adjoining Hudson on west. Drills are now at work.

HAWKINS (Nashwauk)—Dam around O'Brien Lake, a distance of four miles is progressing rapidly. Reservoir so formed will be used in purifying water supply for iron ore concentrators.

CROSBY (Nashwauk)—A new dynamo has just been installed and more men being put to work daily. A washing plant will be built as soon as plans are perfected, and its completion hastened so as to permit of its operation during a part of next season. Plant will be located near Oxide Lake.

MISSOURI-KANSAS-OKLAHOMA

Joplin District

BORUSS (Joplin, Mo.)—Company has made big lead strike. Only small portion of tract has been mined.

KATY (Quapaw, Okla.)—Concentrator is again in operation. Ore from 70 to 100 ft.; good mill recovery.

RICHARDSON (Branson, Mo.)—Good orebodies are available and extensive operations will be conducted.

TEXAS (Thoms Station, Mo.)—Big weekly turn-ins reported. Development shows ground richer than indicated by drill.

OTIS (Joplin, Mo.)—Improvements costing $15,000 are in progress; to complete remodeling of concentrator in two months.

WHITE DOG (Webb City, Mo.)—Operations resumed after 10-days' shutdown for repairs. Ore is mined at 205-ft. level, in sheet ground.

FOOSE MINING CO. (Galena, Kan.)—Operations resumed after shutdown pending zinc market conditions. Concentrator will run steadily.

LUKE LAND (Joplin, Mo.)—J. M. Short & Co. have made another rich strike of zinc ore with drill. Lease adjoins Tecumseh, a good lead producer.

GRASS ROOTS (Galena, Kan.)—Mine has become one of most remarkable in district. Ore was found at 10-ft. level and continued to 50 ft. Now producing heavily.

HARRISON-M'GREGOR TRACT (Carterville, Mo.)—Plans for prospecting campaign have been announced. Shaft will be sunk and concentrator moved to lease.

PRATT (Contact)—Oreshoot has been opened and force of miners will be employed during winter. Ore will be placed on stock pile and shipments made in spring.

DUNDAS (Joplin, Mo.)—New concentrator is ready to start up. Sheet ore found from 90 to 142 ft. Mine is in West Joplin camp, one of busiest in district, operated by D. M. Sayers.

MATTES BROS. (Joplin, Mo.)—Plant idle several weeks to be started up, with modern sludge mill just completed. Company has 1000 tons of ore in bins, withheld pending advance in prices. One concentrator on lease kept in operation.

A. J. YOUNG & CO. (Lawton, Kan.)—This company, operating on Ball land, made sensational strike of zinc ore at 160-ft. level. Six drill holes put down; greatest strike made in last one. Sinking of shaft to be followed by erection of 200-ton concentrator. Lease held by Greenfield, Mo., men.

EDNA LAND (Galena, Kan.)—Twelve companies now operating on tract. Both lead and zinc being produced. William Higgins, of Louisville, Ky., is president and W. S. Pate, of Joplin, is secretary of company holding first lease. Best producers are Cutright & Co., Frazier, Cutright & Co., Lynch & Co., Jarrett, Adams & Co., and Zimmerman & Co.

MONTANA

Broadwater County

OHIO-KEATING MINING CO. (Radersburg)—About 700 tons of ore are shipped per month, assaying about $20 to $30 per ton. Great obstacle to profitable operation at present is expensive haul of 11 miles to railroad.

Jefferson County

BUTTE-BERNICE MINING CO. (Bernice)—Development work is being done on group of seven claims, principal work being on Golden Eagle. Some good ore has been opened and is being mined and sacked until spring, when a cyanide plant will be built in which to treat it.

Silver Bow County

ANACONDA (Butte)—President Thayer has returned from New York. Plans for proposed leaching plant at Washoe works at Anaconda will soon come up for discussion and final decision. It will probably be of 5000 tons daily capacity, modeled after 80-ton experimental plant, which has proved possibilities of process.

NORTH BUTTE (Butte)—Official announcement has been received that company has purchased 739 acres of mineral ground, northwest, north, east and south of Columbia Gar-

dens, practically surrounding Butte & Duluth properties. A cash payment of $794,957 was made out of earnings of company and without drawing on treasury reserve. In addition to cash payment, 20,000 shares of treasury stock of company were issued to patrons preferring stock to cash. At $40 per share, the 20,000 are equivalent to $800,000. Interests still to be transferred within next six months amount to $70,300, making total consideration for new properties $1,665,257. Several claims included in group have been worked by owners and lessees with indifferent success. No definite plans for exploiting new properties have been announced, but it is assumed that methods to be employed will be similar to those now being developed by Butte & Duluth company, that is, opencut mining and leaching ore.

BUTTE & SUPERIOR (Butte)—This company may take over management of Butte-Milwaukee properties if recommendations of directors of latter company are approved by stockholders. At annual meeting of Butte-Milwaukee company, held at Butte, Jan. 7, it was announced that company had no money in treasury for developing and operating its properties and that only way of getting anything done was to bring about a consolidation with the Butte & Superior. Claims owned by Butte-Milwaukee, including Colonel Sellers, Bird, Florence and others have been developed during last year by an agreement with Butte & Superior whereby latter was to expend $24,000. This money was used for sinking Colonel Sellers shaft to 1200 level, cutting stations at that level, connecting 1200 level of Colonel Sellers with 1200 level of Butte & Superior's Black Rock claim and driving a crosscut 300 ft. long to Florence to develop latter claim without sinking a separate shaft. The actual cost of the work was $26,126, which amount was approved by directors of Butte-Milwaukee. With fulfillment of this agreement by Butte & Superior, Butte-Milwaukee properties are again left to drift for themselves unless consolidation with Butte & Superior, suggested at meeting, can be brought about.

NEVADA

Elko County

EASTERN STAR (Gold Circle)—Suit has been filed by Malcolm McDonald estate against A. J. Stinson, W. M. Kearney and Eastern Star Mining Co. for 108,000 shares of stock and $13,500.

Eureka County

HAMILTON MINING & POWER CO. (Eureka)—This company has made shipments recently to U. S. Smelting Co.'s plant at Midvale.

Humboldt County

WHEELER NATIONAL (National)—Capital stock has been increased from 100,000 shares, par value $1 to $250,000.

Lander County

AUSTIN-DAKOTA DEVELOPMENT CO. (Austin)—Hoisting plant has been installed at O. K. incline, preliminary to extensive work. Incline shaft is 125 ft. deep to water, and No. 3 Cameron pump has been installed to empty shaft, after which sinking will be done for 300 ft. further, and crosscuts and drifts driven. Double-H tunnel, now in 180 ft., will be advanced; a blacksmith shop has been built at portal. X-Ray, two-compartment shaft, is 50 ft. deep with good ore at bottom.

Lyon County

MASON VALLEY MINES CO. (Thompson)—Converters were started on Jan. 3. Blister copper is now being shipped.

Mineral County

MUNDA (Bovard)—This group has been bonded for $35,000.

BLACK EAGLE (Rawhide)—The 20-stamp mill is now running steadily and treating daily 60 tons of ore.

NEVADA CHAMPION (Luning)—Work on company account has been discontinued for present; lessees are working on 100-ft. level in shaft.

PROSKEY (Rawhide)—Mill run of 200 tons has given satisfactory results, and compressor and drills are being installed. Oreshoot is 5 ft. wide.

IRONDYKE MINING CO. (Mina)—Crosscut tunnel being driven to cut at depth, oreshoot exposed above nearly completed. Ore will be hauled to New Boston and shipped to Thompson.

NEVADA BLACK & GOLD MARBLE CO. (Mina)—Quarry will be opened at once. Marble is best quality of black and gold and is identical with imported marble of same color, known as Egyptian black and gold. Size of pieces obtainable limited only by handling facilities.

BLACK EAGLE GOLD MINING CO. (Rawhide)—First shipment of bullion from recently built 20-stamp-mill has been made. Mill has been treating 80 tons per day; this will be increased to 100 when machinery is thoroughly adjusted. Mine has been opened to depth of 300 ft., and 30,000 tons of ore, averaging $15 have been developed.

Nye County

NORTH STAR (Tonopah)—Ore will be milled at MacNamara plant. One-year contract has been made.

MANHATTAN MUSTANG (Manhattan)—Lessees have just completed a mill run which averaged $78 per ton on the plates.

WAR EAGLE (Manhattan)—Addition of 10 stamps is being made to mill. When tramway is completed, extensive development will be done on Mustang Hill.

CARRARA MINING & MILLING LEASING SYNDICATE (Carrara)—Three 15-ton chilean mills have been purchased Road building to mine is under way and 200-ton ore bin will be built. Shipments of good-grade ore have been made. Mining of low-grade ore will commence as soon as milling plant is completed.

UMATILLA-TONOPAH (Tonopah)—This company has for last five months been carrying on joint sinking of Umatilla shaft and driving drift with Montana-Tonopah Mining Co. Drift from 1200-ft. station is now in 764 ft., leaving 98 ft. to drive to connect with Montana-Tonopah workings. North crosscut will then be driven to oreshoot. Negotiations are now under way for further joint work, which will include sinking shaft 100-ft. deeper and drifting on 1300-ft. level. Third assessment, 1c. per share, has been levied, due Jan. 26; sale day, Mar. 3, 1914.

Storey County

CONSOLIDATED VIRGINIA (Virginia City)—Water in Consolidated Virginia winze has been lowered to 117-ft. point below 2500-ft. level in C. & C. shaft. When water reaches 125-ft. point, No. 1 Starrett pump will be raised for repairs, one pump being sufficient to handle inflow.

NEW MEXICO

Doña Ana County

ORGAN MOUNTAIN MINING CO. (Las Cruces)—Underground development work is to be started preparatory to beginning of full operations next spring.

PAPEN-HAYNER (Franklin Mountains)—A. J. Papen has moved camp outfit and has taken a number of workmen from Organ district to lead camp in upper end of Franklin mountains. This camp has promise of becoming a lead and silver producer.

Eddy County

HARTFORD OIL CO. (Carlsbad)—A well drilling outfit capable of sinking 3000 ft. has been erected at McKittrick Springs.

Grant County

CHINO COPPER CO. (Hurley)—It has been rumored that officials and engineers will visit Hurley this month relative to adding two units to mill.

BELL & WRIGHT (Pinos Altos)—High-grade pockets are being encountered by these lessees who are working Pacific vein and regular shipments are being made to smelter.

85 MINE (Lordsburg)—A short time ago carbonates and oxides were encountered 750 ft. below surface. Mine is making large shipments to smelter and employing a large force of men.

Lincoln County

HOMESTAKE (White Oaks)—The 20-stamp mill is running steadily on ore said to average $20 in gold. Wild Cat Leasing Co. is in charge of operations.

YELLOW JACKET (White Oaks)—About 200 tons of high-grade iron ore is being shipped daily to Colorado Fuel & Iron Co. plant at Pueblo, Colo. It is claimed that this ore averages about 60% iron.

Sandoval County

COSSAK MINING CO. (Bland)—It is reported that company will build a 100-ton mill, first shipment of machinery to arrive early part of January. Property has been worked by Navajo Mining Co. in past.

Socorro County

PACIFIC MINES CO. (Mogollon)—Newly installed electric equipment is temporarily idle, pending repairs to hydro-electric plant furnishing power. A broken drive shaft will have to be replaced.

LINCOLN MINING & DEVELOPMENT CO. (Mogollon)—New equipment, including gasoline hoist, compressor and machine drills, has reached Silver City and will be hauled out as soon as teams can be procured.

OREGON

Grant County

BLACK BUTTE MINING CO. (John Day)—Property is to be sold by sheriff to satisfy claims of creditors, amounting to several thousand dollars. A small quartz mill erected two years ago is only machinery on property.

Jackson County

BEAR CREEK PLACERS—The Forbes company has secured leases from owners along flats of Bear Creek extending a distance of several miles from town of Phœnix to Talent and will install a dredge.

Josephine County

SIMMONS-CAMERON-LOGAN PLACERS (Illinois Valley)—New workings have been opened up on these placers. Double-lift Henry elevators have been installed and good cleanups have been made.

GRANTS PASS & CRESCENT CITY R.R.—Ten miles of the grade is completed at a cost of $32,000 and is ready for ties and rails which will be laid as soon as funds are available from recent sale of bonds to Denver men.

OLD GLORY MINE (Silver Creek district)—Work will be carried on all winter. Property is a hydraulic placer equipped with 1100 ft. of pipe, a No. 1 giant, and a ditch furnishing 317-ft. pressure. There is also a rich quartz vein on property which is being developed. Foundations for a mill are being built. Considerable water power will be developed.

ANDERSON PLACER (Sucker Creek)—Thomas Wilson who recently purchased this placer is on ground to look after development of mine. Work has been in progress since time he took mine over. Modern hydraulic plant will be installed, making property one of the best equipped placers in district. Gravel was so rich that it paid former owner to pack it on animals to creek, a distance of over a mile.

PENNSYLVANIA

Bucks County

RADIUM CO. OF AMERICA (Sellersville)—The new radium factory is in operation and made its first shipment last week. Angus Cameron, of Baltimore, is president. Technical director is Dr. Siegfried Kohn, an Austrian chemist, and friend of Mme. Curie. About 40 workmen are employed. Ore which is being worked comes from Green River, Utah and Paradox Valley and other parts of Colorado.

SOUTH DAKOTA

Lawrence County

HEIDELBERG (Two Bits)—Company will commence shipping ore to smelter by Feb. 1.

MOGUL (Terry)—Finishing touches are being put on new 150-ton mill, and it is hoped to have plant running by Feb. 1.

TITANIC (Carbonate)—Crosscutting and drifting is under way from 150-ft. level. Ore is expected near porphyry dike, about 75 ft. from shaft.

GOLDEN CREST (Galena)—Title to property has passed to F. W. Bird under judgment sale. Anticipating this he has done considerable development last few months and claims large body of low-grade ore near surface which could be advantageously mined with steam shovels. There is an excellent modern 40-stamp mill on property, and it is hoped to have it in operation shortly, now that title has been adjusted.

HOMESTAKE (Lead)—Improvements to cost $350,000 are planned for 1914. Boiler plant, containing six 600-hp. boilers, will operate new hoisting engine at B. & M. shaft and auxiliary electric plant, of 3200 hp. normal, 4000 hp. continuous, and 4800-hp. maximum capacity. Boiler installation will cost $100,000; hoist about $75,000 and electric plant $45,000, exclusive of buildings, which will total about $130,000 for three plants. New hoisting engine will be one of the finest in United States, with a capacity of 3000 ft. Company at present time is utilizing 10,625 hp., from hydro-electric plants on Spearfish Creek and at Englewood, and from various steam plants at hoists. New boiler plant will give maximum total of 15,425 hp. Investigations are being made as to possibilities of using oil for fuel under new boilers, and if satisfactory prices can be secured, this fuel will be adopted. Hoisting plant is being installed at shaft of Belt Development Co. Shaft will be unwatered and repaired and used for ventilation purposes.

Pennington County

FIRST NATIONAL (Hill City)—This, formerly the Forest City property, continues development by drifting. Ten-stamp mill will be put in operation in a short time.

DAKOTA CONTINENTAL COPPER CO. (Calumet)—Company has unwatered 800-ft. shaft to 700-ft. level and is installing a Rumsey pump. Will sink to 1000 ft. and then drift.

UTAH

Juab County

IRON BLOSSOM (Silver City)—Quarterly dividend of 10c. per share, or $100,000 to be paid Jan. 20.

GRAND CENTRAL (Mammoth)—Owing to unusual expense in development fourth dividend in 1913 was passed. Present year begins with payment on Jan. 24 of a dividend of 5c. per share, or $25,000, usual quarterly amount.

Salt Lake County

UTAH METAL (Bingham)—A statement to stockholders shows that 440,000 gal.of water daily from this company's tunnel is being supplied to Utah Copper Co., which on Dec. 4, 1913, completed a pipe line from Middle Cañon side to Bingham Cañon side of West Mountain. It is expected to further develop springs on Middle Cañon side, and to increase supply to be furnished Utah Copper. Water is also supplied to the Bingham-New-Haven, and contracts with other mining companies and the town of Bingham are expected. Contracts are being negotiated for hauling waste and mill tailings through tunnel to dump in Middle Cañon, problem being now to contract for all possible use of the tunnel for hire. Drifting is being done from 9100-ft. point in tunnel toward west in direction of Bingham-New Haven in a 3-ft. vein in limestone, and short crosscuts will reach porphyry contact. Good milling and shipping ore are being found, and some large deposits are expected. A drift to the east at 8600-ft. point is in mineralized ground and has progressed 244 ft. If present work opens ore in paying quantity, other veins cut in driving tunnel will be prospected.

Summit County

PARK CITY SHIPMENTS for week ended Jan. 10 amounted to 2,775,180 lb., shippers being Daly-Judge, Silver King Coalition, Silver King Consolidated, and American Flag. An effort is being made by operating mines of Park City to provide employment as far as possible, especially for married men thrown out of work by Daly West fire.

ONTARIO SILVER MINING CO. (Park City)—This company will continue operations as usual, in spite of Daly-West fire.

THOMPSON-QUINCY (Park City)—Work suspended on account of Daly-West fire has been resumed, air being furnished by Daly-Judge.

MINES OPERATING CO. (Park City)—An average of 165 tons daily was treated during week ended Jan. 10 in this company's mill. Cost of extracting ore from old stopes in Ontario mine under lease to company has been reduced; and, with this satisfactory output from mill, good earnings are expected. Mill has been in operation a little more than a year.

DALY WEST (Park City)—In a letter to stockholders general manager states that insurance on mill recently destroyed by fire is sufficient to permit rebuilding with almost no loss except that entailed through time taken up in rebuilding, etc. Pending issuance of annual report, letter contains a short account of affairs of company, giving reasons for passing of dividends since January, 1913, and describing in brief present condition of property. Purchase of adjoining ground and interests, mentioned in last annual report, have finally been concluded at a total cost of $136,271. Eearly in year there was a decrease in amount of shipping ore available, and milling ore, although continued in quantity, showed a lessened metallic content. In last four months, however, shipments of crude ore have been augmented, with an increased tonnage of shipping ore in sight; and milling ore has shown an increase in value. Prospecting throughout the year has resulted in exposure of new orebodies. Cash balance is being added to from monthly earnings free from indebtedness.

WASHINGTON

Ferry County

CENTRAL REPUBLIC (Republic)—Company is planning some extensive development work for coming season.

KETTLE RIVER (Rock Cut)—A recent shipment of ore showed 63% lead, as well as good values in silver. Operations will continue throughout winter.

Stevens County

AMAZON (Chewelah)—Oppenheimer Bros. have resumed operations and hope to soon have mine on shipping basis.

WYOMING

Crook County

CAMP BIRD (Sundance)—Shaft is being sunk and development work will be done.

BEAR LODGE MINING CO. (Sundance)—Hoist capable of sinking to a depth of 1000 ft. is being installed.

BEAVER MINING CO. (Sundance)—Company was recently incorporated and has taken over property adjoining Bear Lodge property. Active work will commence in spring.

CANADA

British Columbia

LACK OF SNOW AT SHEEP CREEK, Nelson district, is retarding haulage of ore.

NICKEL PLATE (Hedley)—Dickson incline below No. 4 tunnel is down a little less than 700 ft. from its portal. A station is now being cut, after which sinking in incline will be resumed. Dam on Similkameen River being put in for power purposes will not be built where work was first started, a new location 100 ft. further up river having been selected.

Ontario

LE PALME—It is understood that this property is under option to Coniagas mines.

COBALT LAKE (Cobalt)—It is reported that heavy expenditure incident to pumping lake will necessitate cutting dividend.

HOLLINGER (Timmins)—Winze from 425-ft. level of No. 4 vein has reached a vertical depth of 550 ft., at which a station will be cut and a new level opened.

DOME LAKE (South Porcupine)—It has been decided to sink main shaft to a depth of 400 ft., in hope of finding longer oreshoots. Property is now under control of Hudson Bay mines in Cobalt.

BEAVER AUXILIARY (Cobalt)—Underground work has been stopped, a shortage of water being given as reason. It is understood, however, that grade of ore encountered in underground workings is erratic.

NORTHERN ONTARIO EXPLORATION CO.—At a meeting in London Jan. 14, shareholders assented to proposal to amalgamate with California Exploration Co. Shareholders will get three shares of California company for every two of Ontario company.

McINTYRE (Schumacher)—While no official information has as yet been given, it is understood that deal for Pearl Lake by this company has been closed and McIntyre management is working from Pearl Lake shaft at a depth of 600 ft. McIntyre mines agree to do development work for Pearl Lake to extent of expediture of $1000 per month. This deal will be beneficial to Pearl Lake company as it is without sufficient funds to carry on development itself.

CHAMBERS-FERLAND (Cobalt)—Shareholders have received circulars from London, announcing intention to make effective, proposal outlined at a meeting held in Toronto last June, when plan was submitted of offering one £1 share of Aladdin Cobalt, Ltd., a company with a capitalization of £500,000, in exchange for 20 Chambers-Ferland shares. Shareholders are asked to enter into the exchange agreement at once as it will be void to shareholders who have not deposited their script within one month from date of circular, which brings closing date to Feb. 1.

Quebec

CANADIAN-VENEZUELAN ORE CO.—A meeting of bond holders was to be held, Jan. 13, when F. P. Jones, president, was to report as to financial position of company. A number of unfavorable reports have recently appeared in daily press regarding financial position of company, but directors decline to comment on these until president's report has been given to shareholders.

MEXICO

DECLINE IN MEXICAN MINING SECURITIES within the last four years of political unrest are shown in the following table:

	1910 Dec. 31	1911 Dec. 31	1912 Dec. 31	1913 Dec. 31
Peñoles	155	120	167	114
Chontalpan	82	45	77	130
Blanca y Anexas	95	80	71	62½
Cruz de Zimapan	15	13	...	...
Maravilas y San Francisco	240	305	230	135
Nuevo Guatimotzin	102	35	28	24
Reina	32	15	...	6
San Rafael y Anexas	91	94	34	24½
Alacran	475	415	315	340
Carboncillo	170	65	28	30
Oro Nolan	700	390	250	230
Seguranza	16	6.50	1.00	0.50
Natividad	35	26	18	60
Santa Maria de la Paz	411	205	380	260
Zaragoza	140	95	75	65

GERMAN SOUTHWEST AFRICA

COPPER ORE HAS BEEN DISCOVERED AT LEEIS, according to report from H. M. Consul at Lüderitzbucht. Leeis is about 30 miles east of Windhuk. Outcrop has been followed for two or three miles, and work has been started.

The Market Report

METAL MARKETS

NEW YORK—Jan. 21

The metal markets have been generally inclined to be quiet, with small changes in quotations.

Copper, Tin, Lead and Zinc

Copper—During the last week a very large business, amounting to many millions of pounds, was done, chiefly for export. Foreign buyers evidently regarded prices as low and began to replenish their depleted stocks. American buyers are believed to be bare of supplies. Some buying by them developed, but the European buying greatly predominated. The largest transactions occurred early in the week and began at 14c., delivered, usual terms, equivalent to about 13.80@13.85c., net cash, New York, on the average. The buying was sufficient, both in character and volume, to advance prices right along, the closing of each day being higher than the opening, until on Jan. 20 about 14⅜c., delivered, usual terms, became the well established price. On Jan. 21, copper continued to be readily available at that price, although certain agencies were nominally asking more. All through the week the agencies made nominal quotations to talk about and shaded them materially when business was to be done. The situation of Lake copper remains unchanged and quotations are but nominal. The market for electrolytic copper closes strong. The average of our quotations for the week is 14.04 cents.

The standard market has been active and strong. On Thursday, Jan. 15, spot was £63 12s. 6d., three months £64; on Jan. 16, spot advanced to £64 1s. 3d. three months to £64 8s. 9d.; on Jan. 19 it advanced to £64 8s. 9d. and £64 16s. 3d., respectively, and on Jan. 21, it closes at £64 15s. for spot and £65 for three months.

Base price of copper sheets is 20¼c. per lb. for hot rolled and 21¼c. for cold rolled. The usual extras are charged and higher prices for small quantities. Copper wire is 15¾ @16c., carload lots at mill.

Exports from New York for the week included 5257 long tons of copper. Our special correspondent reports the exports from Baltimore for the week at 1958 tons copper.

Visible stocks of Copper in Europe on Jan. 15, are reported as follows: Great Britain, 11,120; France, 2580; Rotterdam, 3750; Hamburg, 3900; Bremen, 1120; other European ports, 950; total 23,420 long tons, or 52,460,800 lb. This is a decrease of 650 tons from Dec. 31. In addition to the stocks above 2000 tons are reported afloat from Chile and 3400 from Australia, making a total of 28,820 tons.

Tin—The London market developed an improving tendency, which was brought about by the fact that Far Eastern sellers had become very reluctant in making offers; in fact, had entirely withdrawn from the market. American buying in the London market was of a negligible quantity, particularly as dealers in this market are still willing to supply consumers with the metal at somewhat below the prices at which it can be laid down here. Advices from consuming centers in this country are of a more encouraging nature, but as users of the metal covered a large part of their requirements some time ago, this at the present time does not find expression in large purchases. The market closes firm at £173 10s. for spot, £174 15s. for three months, and about 38⅛c. for January tin here.

Corrected statement of tin exports from the Straits, year ended Dec. 31, gives 61,757 tons in 1912, and 64,608 in 1913; increase, 2851 tons.

Tin output of Federated Malay States year ended Dec. 31 was 48,421 long tons in 1912, and 49,298 in 1913; increase 877 tons.

Messrs Robertson & Bense report the arrivals of tin ore and concentrates at Hamburg, Germany, in December at 2282 tons, of which 2268 tons were from Bolivia and 14 tons from South Africa.

Lead—More business is reported at last prices, 4.10c. New York and 3.95@4c. St. Louis.

The London market has been strong and advancing. Spot material continues scarce. Spanish lead, for prompt delivery, is quoted £20 7s. 6d. and English lead 12s. 6d. higher.

Spelter—The market has been dull, with not much demand, and on the other hand no pressure to sell. The business reported is so small that quotations are scarcely more than nominal. The metal has been offered right along at 5.10c., St. Louis, without finding buyers.

The London market for good ordinaries is a trifle lower at £21 10s.; specials 7s. 6d. higher.

Base price of zinc sheets is $7.50 per 100 lb. in carload lots, f.o.b. Peru, Ill., less 8% discount.

Bismuth—Quotations at New York are $1.80 per lb. for imported metal and $1.72 per lb. for metal from domestic ores. The London price is 7s. 6d. per lb. The price is still controlled by the European Syndicate.

DAILY PRICES OF METALS

NEW YORK

January	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb	St. Louis, Cts. per lb.	New York, Cts. per lb.	St Louis, Cts. per lb.
15	4.8665	57½	*14 @15	13.80 @13.90	37	4.10	3.95 @4.00	5.20 @5.25	5.05 @5.10
16	4.8630	57½	*14 @15	13.90 @14.00	37½	4.10	3.95 @4.00	5.20 @5.25	5.05 @5.10
17	4.8635	57¾	*14 @15	13.95 @14.00	37½	4.10	3.95 @4.00	5.20 @5.25	5.05 @5.10
19	4.8635	57¾	*14½ @15	14.00 @14.10	37½	4.10	3.95 @4.00	5.20 @5.25	5.05 @5.10
20	4.8620	57½	*14½ @15	14.12½ 14.25	37¾	4.10	3.95 @4.00	5.20 @5.25	5.05 @5.10
21	4.8620	57½	*14½ @15	14.20 @14.25	38¼	4.10	3.95 @4.00	5.20 @5.25	5.05 @5.10

*Nominal.

The quotations herein given are our appraisal of the markets for copper, lead, spelter and tin based on wholesale contracts; and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.15c. apart. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic; of casting copper 0.15 to 0.25c. below. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals; per 100 lb., are: St. Louis-New York, 15½c.; St. Louis-Chicago,6c.; St. Louis-Pittsburgh, 12½c.; New York-Bremen or Rotterdam, 15c.; New York-Havre, 16@17½c.; New York-London, 16c.; New York-Hamburg, 18c.; New York-Trieste,22 c.

LONDON

January	Silver	Copper				Tin		Lead		Zinc	
		Spot		3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
		£ per Ton	Cts. per Lb.								
15	26½	63¾	13 82	64	68½	168	169¾	19½	4 26	21 5/16	4 68
16	26½	64 1/16	13 94	64 1/16	69½	168¾	170½	20¼	4.40	21 5/16	4.68
17	26½	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
19	26 5/16	64 1/16	14 00	64 1/16	69½	170½	172	20¾	4 43	21½	4.67
20	26½	64¼	14 04	64¾	69¾	172¼	173½	20¾	4 43	21½	4.67
21	26½	64¾	14 07	65	70	173½	174¼	20¾	4 43	21⅝	4.70

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latte being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21¾c.

British Foreign Trade in Metals, other than iron and steel, year ended Dec. 31 is reported as follows, figures being in long tons, except quicksilver which is in pounds:

Metals:	Imports 1912	Imports 1913	Exports 1912	Exports 1913
Copper	130,591	135,928	57,451	72,517
Tin	43,157	45,682	44,706	41,691
Lead	205,375	204,136	58,634	62,343
Zinc	157,614	163,772	10,518	11,128
Minor metals	7,886	9,830	28,250	26,856
Quicksilver, lb.	3,544,691	3,401,165	2,418,643	2,011,181
Ores, etc.:				
Tin, ore and concentrates	28,652	34,592	.....	.....
Pyrites	907,157	781,711	.....	.....

Copper includes metallic contents of ores and matte. Exports include reëxports of foreign material.

British Foreign Trade in Iron and Steel and in machinery for the year ended Dec. 31 is valued as below by the Board of Trade returns:

	Exports	Imports	Excess
Iron and steel	£54,328,292	£15,230,694	Exp. £39,097,598
Machinery, hardware, etc	61,437,946	16,246,281	Exp. 45,191,665
Total	£115,766,238	£31,476,975	Exp. £84,289,263
Total, 1912	101,133,319	28,231,646	Exp. 72,901,673

New ships built for foreign countries are included in the exports. Actual tonnage of iron and steel exported was, 4,807,528 in 1912, and 4,935,203 in 1913; imported, 1,996,771 in 1912, and 2,219,902 last year.

Other Metals

Aluminum—The market remains rather quiet, with only moderate demand. Prices show no material change, No. 1 ingots being quoted at 18¾@19c. per lb., with futures a shade higher.

London quotations are above New York parity, the latest price noted for No. 1 ingots there being £83 per long ton, equal to 18.03c. per lb.; to which freight and duty must be added.

Antimony—The market is in better shape than it has been. There has been steady buying both for spot and forward delivery, indicating more confidence and better demand. Prices are unchanged. Cookson's is 7.30@7.40c. per lb.; Hallett's 7@7⅛c.; while for Hungarian, Chinese and other outside brands, 6@6¼c. per lb. is named.

Quicksilver—Business is rather quiet but steady, with prices unchanged. New York quotation is $38@39 per flask of 75 lb. for large lots. Jobbing price is 54@55c. per lb. San Francisco, $38.50 per flask for domestic orders. London price is £7 10s. per flask, with £7 quoted from second hands.

Cadmium—German quotation is 750 marks per 100 kg.—equal to about 81c. per lb.—f.o.b. works in Silesia.

Magnesium—The current quotation for pure metal is $1.50 per lb. for lots of 100 lb. or over, at New York.

Nickel—Quotations for ordinary forms—shot, blocks, or plaquettes—are 40@45c. per lb., according to size or order and quality. Electrolytic nickel is 5c. per lb. higher.

Selenium—For large lots, 100 lb. or over, $3@3.25 per lb. is quoted; while $5 per lb. is paid for retail orders. Exports from Baltimore for the week included 1102 lb. selenium to Hamburg, Germany.

Gold, Silver and Platinum

Gold—The price of gold in the open market in London was unchanged at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. In New York $2,000,000 were taken late last week and $2,000,000 more this week for shipment to Paris, and it is said that more will go soon.

Gold movement in Great Britain for the year ended Dec. 31 was:

	1912	1913	Changes
Imports	£52,688,881	£59,533,849	I. £6,844,968
Exports	46,538,469	46,087,359	D. 451,110
Excess, imports	£6,150,412	£13,446,490	I. £7,296,078

The heavier imports in 1913 were £40,794,859 from South Africa, £4,006,867 from Brazil, £3,838,378 from Argentina and £2,749,810 from India.

Net imports of gold into India for the month of December were £1,875,866; for the year ended Dec. 31 they were £18,547,597, which is about 30% less than in the previous year.

Iridium—Conditions are unchanged, but there is a little more range, quotations being $75@78 per oz. New York.

Platinum—The market is quiet and almost sluggish, with the quotations a shade firmer, at $43@44 per oz. for refined platinum and $46@49 per oz. for hard metal.

A report comes from London, that the export tax on crude platinum, authorized some time ago by the Russian Duma, will be put in force Feb. 1. The report has not been confirmed as yet.

Our Russian correspondent writes under date of Jan. 5 that the market has been very quiet, as is usually the case over the holidays. The large dealers are holding back, expecting lower prices. Quotations at Ekaterinburg are 9.65 rubles per zolotnik; at St. Petersburg 37,100 rubles per pood—equal to $36.28 and $36.36 per oz. respectively—for crude metal, 83% platinum. Orders have been placed for two new dredges to be ready for work in the Urals next season.

Silver—The market continues quiet with limited business. Price keeps steady about 26½d. in London, but buyers are able to satisfy their wants without any advance in price, and the tendency, if any, is rather toward lower figures. The probability is that no great decline is pending, owing to contraction of supplies in London from this side.

Shipments of silver from London to the East for the year from Jan. 1 to Jan. 8; as reported by Messrs. Pixley & Abell:

	1913	1914	Changes
India	£ 5,500	£ 65,000	I. £ 59,500
China	10,000	.....	D. 10,000
Total	£ 15,500	£ 65,000	I. £ 49,500

Imports of silver into Great Britain for the year ended Dec. 31 were valued at £14,495,049; exports, £16,054,679; excess of exports, £1,559,630, against £1,554,715 in the preceding year.

Zinc and Lead Ore Markets

JOPLIN, MO.—Jan. 17

Zinc blende sold as high as $44, the assay base ranging from $43 to $39, the metal base from $39 to $37 per ton of 60% zinc. The calamine base is $20@23 per ton of 40% zinc. The average of all grades of zinc is $39.30 per ton. Lead ore sold as high as $53.60 on a base of $50 per ton of 80% metal content, and the average of all grades is $49.86 per ton. Outputting conditions continued excellent and preparations are under way for the opening of a number of new mines in the spring. Exceptionally fine, warm weather has facilitated preparations for extended operations in March and April should February and March prove favorable to continued activity.

SHIPMENTS WEEK ENDED JAN. 17

	Blende	Calamine	Lead	Value
Total this week	10,995,640	791,120	2,303,510	$289,140
Total this year	31,087,350	1,753,730	5,880,690	785,645

Blende value, the week, $222,500; 3 weeks, $622,420.
Calamine value, the week, $9110; 3 weeks, $17,925.
Lead value, the week, $57,530; 3 weeks, $145,300.

PLATTEVILLE, WIS.—Jan. 17

The base price paid this week for 60% zinc ore was $40.50@41 per ton. The base price paid for 80% lead ore was $51@52 per ton.

SHIPMENTS WEEK ENDED JAN. 17

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore lb.
Week	2,267,880	71,140	991,620
Year to date	7,279,650	137,140	2,921,090

Shipped during week to separating plants, 2,611,040 lb. zinc ore.

IRON TRADE REVIEW

Accounts from the iron and steel trades are more encouraging. Mills are enlarging their operations, running more nearly to capacity and employing more men.

The steel market shows no further improvement this week, over the better conditions which were manifest in the first two weeks of the year, but all the ground gained has been held. Steel prices remain firmer than they were three or four weeks ago, and thus they have at least rounded a turn, whether or not the improvement turns out to be permanent.

Steel production is now at about 60% of the full rated capacity of the mills, which makes a better showing than was made by December as a whole, though it is not as good a rate as obtained up to the middle of November.

Throughout the trade the sentiment has improved, except in such quarters as are constitutionally unable to see anything good under present legislative conditions. In most quarters in the steel trade President Wilson's trust message is likely to prove reassuring rather than otherwise, through

its dealing with practical questions of monopoly rather than theoretical questions arising out of the possibility of exercising monopoly; in other words the message appears to be favorable to the United States Steel Corporation rather than otherwise.

Pig iron continues rather depressed, but orders are finding their way to the furnaces more freely than they were. Prices continue low.

PITTSBURGH—Jan. 20

There has been much discussion of the possibility of wage reductions in various branches of the iron and steel industry, and in many instances the discussion has ended in a resolution not to attempt to reduce wages at this time. It seems fairly safe to predict that there will be no general wage reductions in the industry in the near future.

Pig Iron—While the market has been rather quiet locally, there is increased disposition on the part of consumers to take hold for deliveries well into the future, on the ground that prices cannot possibly go much lower and may easily show a higher average than the present, over the next six months. Some important Valley furnace interests have marked up their asking prices on bessemer and basic iron and would not sell even prompt iron at the present level. We continue to quote: Bessemer, $14; basic, $12.50; No. 2 foundry, $13; forge, $12.50, at Valley furnaces, 90c. higher delivered Pittsburgh; but foundry has in some cases sold at $13.65, Pittsburgh, from furnaces having less than the Valley freight rate to Pittsburgh.

Ferromanganese—The ferromanganese market is steady at $45, Baltimore, $2.16 freight to Pittsburgh, on prompt and forward, but is locally inactive, since recently the Carnegie Steel Co. covered practically all important consumers who did not already have contracts, on a basis of shading whatever might be the price of foreign material month by month.

Steel—Openhearth sheet bars have been offered at lower figures, down to $20, maker's mill, Youngstown, with the possibility of equalizing freights with Pittsburgh, but it is a question whether there is much more tonnage to be had at such prices. The Carnegie Steel Co. is understood to have withdrawn from the market. Bessemer sheet bars are quoted firm at the old figure. We quote: Billets, $20; openhearth sheet bars, $20; bessemer sheet bars, $21, at maker's mill, Pittsburgh or Youngstown.

Foreign Trade of the United States in iron and steel and in machinery 11 months ended Nov. 30 is valued as follows by the Bureau of Statistics of the Department of Commerce:

	1912	1913	Changes
Exports	$265,377,576	$271,818,359	I. $6,440,783
Imports	26,679,224	30,786,428	I. 4,107,204
Excess, exports	$238,698,352	$241,031,931	I. $2,333,579

The value of machinery exports, included above, was $110,301,241 in 1912, and $117,679,935 last year.

IRON ORE

Nothing has been done yet with regard to fixing prices of Lake iron ore for the coming season. Neither buyers nor producers seem to be in any hurry. The same condition exists in the East, where no business has been done yet in Cuban or other foreign ore.

Imports and Exports of Iron Ore in the United States 11 months ended Nov. 30 were, in long tons:

	1912	1913	Changes
Imports	1,904,594	1,915,733	I. 11,139
Exports	1,186,831	1,027,572	D. 159,259

More than three-quarters of the imports—1,498,587 tons—were from Cuba. Imports of manganese ore were 257,743 tons in 1912, and 304,317 tons in 1913; an increase of 46,574 tons.

British Imports of Iron Ore for the full year were 6,602,483 long tons in 1912, and 7,442,329 in 1913; an increase of 839,846 tons. Imports of manganese ore for the year were 387,738 tons in 1912, and 601,207 tons in 1913; an increase of 213,469 tons.

German Iron Ore Imports in the 11 months ended Nov. 30 were 12,947,304 metric tons; exports, 2,404,857; net imports, 10,542,447 tons. Imports of manganese ore for the 11 months were 616,410 tons; exports 8417; net imports, 607,993 tons.

COKE

Little business has been done in Connellsville coke, furnace buyers not being active, while makers hold for $2 per ton. The make has been lessened by severe weather. The total output reported last week was 260,670 tons, of which the furnace interests made 166,370 and the merchant ovens 94,310 tons. Shipments for the week were 258,459 tons.

Connellsville Coke—There is tentative inquiry in the market from two or three large consumers for forward delivery, but all consumers appear to be covered for January at least. The prompt market is about $1.90, with contract coke at $1.90@2 at ovens.

Exports and Imports of Fuel in the United States 11 months ended Nov. 30, long tons:

	Exports		Imports	
	1912	1913	1912	1913
Anthracite	3,404,958	3,927,995	1,670	913
Bituminous	13,549,753	16,856,781	1,480,503	1,035,887
Coke	735,059	805,320	95,732	78,913
Bunker coal	6,766,443	7,093,271	.....	.....
Total	24,456,213	28,683,367	1,577,905	1,115,713

The bunker coal, or coal furnished to steamships in the foreign trade, is practically all bituminous.

COPPER SMELTER'S REPORTS

This table is compiled from reports received from the respective companies except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield then is reckoned at 97%. In computing the total American supply duplications are excluded.

	August	September	October	November	December
Alaska shipments	1,847,785	2,261,216	1,951,883	3,391,300	3,104,155
Anaconda	22,500,000	22,600,000	18,400,000	25,250,000	25,100,000
Arizona, Ltd.	1,800,000	1,800,000	3,550,000	2,800,000	1,920,000
Copper Queen	8,252,404	8,434,803	8,292,929	7,115,991	9,033,459
Calumet & Ariz.	4,500,000	4,000,000	4,500,000	4,600,000	5,230,000
Chino	5,788,572	4,196,296	4,767,466	4,270,821	.....
Detroit	2,187,223	2,102,818	1,861,878	1,922,352	2,021,034
East Butte	1,162,007	1,233,018	1,040,997	1,902,190	.....
Giroux	524,953	198,178	156,084	.....	.....
Mason Valley	867,060	918,000	1,052,000	1,174,000	.....
Mammoth	1,750,000	1,750,000	1,700,000	1,700,000	1,400,000
Nevada Con.	5,989,973	4,441,671	5,898,046	5,443,647	.....
Ohio	689,000	685,900	698,691	772,120	.....
Old Dominion	2,524,000	2,679,000	2,037,000	2,450,000	2,613,000
Ray	4,269,519	4,336,434	4,725,419	4,753,964	.....
Shannon	1,248,000	1,233,000	1,216,000	1,110,000	1,078,000
South Utah	223,498	241,843	232,269	225,072	.....
Tennessee	1,101,019	1,309,985	1,392,162	1,666,753	1,700,000
United Verde*	3,000,000	3,000,000	3,000,000	3,000,000	.....
Utah Copper Co.	10,302,251	11,463,905	9,929,478	10,787,426	10,088,000
Lake Superior*	9,700,000	6,950,008	5,500,000	6,600,000	.....
Non-rep. mines*	6,200,000	6,000,000	6,200,000	6,000,000	.....
Total prod.	96,427,264	91,836,075	88,102,302	.....	.....
Imp., bars, etc.	22,473,471	35,703,660	21,935,023	21,796,866	.....
Total blister	118,901,735	127,539,735	110,037,325	.....	.....
Imp. ore & matte	9,171,351	10,800,162	5,062,015	8,980,186	.....
Total Amer.	128,073,086	138,339,897	115,099,340	.....	.....
Miami†	3,097,500	2,688,000	2,862,050	3,230,000	.....
Shattuck-Arizona	1,001,634	1,163,237	993,224	995,429	1,050,781
Brit. Col. Cos.:					
British Col. Cop.	647,905	621,120	688,581	.....	.....
Granby	1,847,344	1,824,659	1,718,258	1,944,145	.....
Mexican Cos.:					
Boleo†	2,264,640	2,369,920	2,424,800	2,315,040	2,315,040
Cananea	3,186,000	3,148,000	3,682,000	3,800,000	3,646,000
Moctezuma	3,542,047	3,024,121	3,178,136	3,517,800	3,139,613
Other Foreign:					
Braden, Chile	1,572,000	1,332,000	2,006,000	1,592,000	2,122,000
Cape Cop., S. Af.	.....	607,040	712,320	649,600	.....
Kyshtim, Russia	1,585,000	1,187,000	.....	.....	.....
Spassky, Russia	1,048,320	1,025,920	983,360	904,960	.....
Exports from					
Chile	8,736,000	5,600,000	6,160,000	7,616,000	.....
Australia	7,720,000	6,944,000	7,728,000	11,200,000	.....
Arrivals–Europe‡	14,624,960	9,661,120	18,040,960	9,107,840	.....

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.
‡ Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

Month	United States			Visible Stocks.		
	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
Year. 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I. 1913.	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II.	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III.	136,251,849	76,585,471	77,699,306	122,302,890	81,244,800	203,547,690
IV.	135,353,402	78,158,837	85,894,727	104,269,270	87,180,800	191,450,070
V.	141,319,416	81,108,321	68,285,978	75,549,108	85,948,800	161,497,908
VI.	121,860,853	68,362,571	68,067,901	67,474,225	77,235,200	144,709,425
VII.	138,074,602	58,904,192	78,480,071	52,814,606	77,904,000	124,808,606
VIII.	131,632,362	73,649,801	73,263,469	53,594,945	66,420,480	120,015,385
IX.	131,401,229	66,836,897	73,085,275	38,314,037	63,716,800	102,030,837
X.	139,070,481	68,173,720	68,123,473	29,793,094	53,625,600	83,418,692
XI.	134,087,708	48,656,858	70,067,803	32,566,382	48,787,200	81,353,582
XII.	138,990,421	21,938,570	73,542,413	47,929,429	46,592,000	94,521,429
Yr., '13	1,622,450,829	767,261,760	869,062,784	.....	.....	.....
I, 1914.	.....	.....	.....	91,438,867	53,916,800	145,355,667

Note—Visible supplies in Europe do not include copper afloat.

Mining Companies—United States

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt.
Acacia, g.	Colo.	1,438,989	$ 1	$ 122,004	Jan '11	$0.01
Adams, s.l.c.	Colo.	80,000	10	778,000	Dec. '09	0.04
Ahmeek, c.	Mich.	50,000	25	2,100,000	Oct. '13	3.00
Alaska Mexican, g.	Alas.	180,000	5	3,273,381	Nov. '13	0.20
Alaska Treadwell, g.	Alas.	200,000	25	13,785,000	Dec. '13	1.00
Alaska United, g.	Alas.	180,200	5	1,576,750	Nov. '13	0.50
Am. Zinc, Lead & Sm.	U. S.	165,360	25	985,820	Apr. '13	0.50
Anaconda, c.	Mont.	4,332,500	25	81,418,125	Oct. '13	0.75
Argonaut, g.	Calif.	200,000	5	1,200,000	June '10	0.05
Arizona Copper,	Ariz.	1,426,120	1.20	1,890,621	Oct. '13	.....
Arizona Copper, com.	Ariz.	1,519,896	1.20	15,984,474	Nov. '13	.....
Bagdad-Chase, g., pf.	Calif.	84,819	5	202,394	Jan. '09	0.10
Baltic, c.	Mich.	100,000	25	7,950,000	Dec. '13	2.00
Bingham N. H., c.	Utah	228,690	5	339,957	Nov. '13	0.10
Bonanza Dev., g.	Colo.	300,000	1	1,425,000	Oct. '11	0.20
Bunker Hill Con., g.	Calif.	200,000	1	791,000	Dec. '13	0.05
Bunker Hill & Sul., l.s.	Ida.	327,000	10	14,729,250	Dec. '13	0.25
Butte-Alex Scott, c.	Mont.	74,000	10	148,000	Oct. '13	0.50
Butte & Ballaklava, c.	Mont.	250,000	10	125,000	Aug. '10	0.50
Caledonia, l.s.c.	Ida.	1,300,000	1	52,000	June '10	0.01
Calumet & Arizona, c.	Ariz.	596,353	10	19,026,805	Dec. '13	1.25
Calumet & Hecla, c.	Mich.	100,000	25	123,250,000	Dec. '13	6.00
Camp Bird, g.s.	Colo.	1,100,051	5	9,650,812	Aug. '13	0.24
Centen'l-Eur., l.s.g.c.	Utah	100,000	5	3,900,000	Oct. '13	1.50
Center Creek, l.z.	Mo.	100,000	10	495,000	Nov. '13	0.05
Champion, c.	Mich.	100,000	25	8,500,000	Oct. '13	1.00
Chief Consolidated, s.g.l.	Utah	876,453	1	174,277	Aug. '13	0.10
Cliff, g.	Utah	300,000	1	90,000	Jan. '13	0.10
Cliff, g.	Alas.	100,000	1	210,000	Oct. '13	0.01
Colo. Gold Dredging	Colo.	100,000	10	300,000	Oct. '13	0.25
Colorado, l.s.g.	Utah	1,000,000	0.20	2,570,000	Dec. '12	0.03
Columbus Con., g.s.	Utah	285,540	5	226,832	Oct. '07	0.20
Commercial Gold	Ore.	1,750,000	1	43,750	Dec. '10	0.00½
Con. Mercur, g.	Utah	1,000,000	1	3,445,313	July '13	0.03
Continental, z.l.	Mo.	22,000	25	297,000	July '13	0.50
Copper Range Con., c.	Mich.	393,445	100	13,985,021	Oct. '13	0.75
Daly Judge, s.l.	Utah	300,000	1	675,000	Dec. '13	0.15
Daly West, s.l.	Utah	180,000	20	6,606,000	Jan. '13	0.15
Doctor Jackpot, g.	Colo.	3,000,000	0.10	45,000	Mar. '11	0.00½
Doe Run, l.	Mo.	65,782	100	3,550,969	Dec. '13	0.76
Elkton Con., g.	Colo.	2,500,000	1	3,279,460	Nov. '13	0.02
El Paso, g.	Colo.	460,000	5	1,658,545	Mar. '13	0.12½
Ernestine, g.s.	N.M.	300,000	5	165,000	Mar. '13	0.05
Fed. M. & S., com.	Idaho	60,000	100	2,708,750	Jan. '09	1.50
Fed. M. & S., pf.	Idaho	120,000	100	8,387,643	Dec. '13	1.50
Florence, g.	Nev.	1,050,000	1	840,000	Apr. '11	0.10
Frances-Mohawk, g.	Nev.	912,000	1	546,000	Jan. '08	0.05
Free Coinage, g.	Colo.	10,000	100	180,000	Dec. '09	1.00
Fremont Con., g.	Calif.	200,000	2.50	214,000	Nov. '13	0.02
Frontier, z.	Wis.	1,250	100	146,202	Nov. '13	2.00
Gemini-Key'ne, l.g.s.	Utah	5,000	100	2,230,000	Dec. '13	10.00
Gold Chain, g.	Utah	1,000,000	1	130,000	May '13	0.03
Gold Coin of Victor	Colo.	1,000,000	1	1,350,000	Feb. '09	0.02
Gold Dollar Con.	Colo.	2,500,000	0.10	100,000	Dec. '12	0.00½
Gold King Con., g.	Colo.	5,750,370	1	1,407,319	Dec. '11	0.03
Golden Cycle, g.	Colo.	1,500,000	5	2,595,000	Dec. '13	0.03
Golden Star, g.	Ariz.	400,000	5	140,000	Mar. '10	0.05
Goldfield Con., g.	Nev.	3,558,367	10	26,330,470	Oct. '13	0.40
Grand Central, g.	Utah	500,000	1	1,545,750	Sept. '13	0.05
Granite, g.	Colo.	1,650,000	1	269,500	Nov. '12	0.01
Hazel, g.	Cal.	900,000	1	971,000	Dec. '13	0.01
Hecla, l.s.	Idaho	1,000,000	0.25	2,970,000	Dec. '13	0.02
Hercules, l.s.	Idaho	1,000,000	1	3,650,000	July '11	0.06
Homestake, g.	S. D.	218,400	100	34,271,966	Dec. '13	1.65
Horn Silver, l.s.z.	Utah	400,000	25	5,662,000	Sept. '07	0.05
Iowa, g.s.l.	Colo.	1,666,667	1	216,832	July '13	0.00½
Iowa-Tiger Leasing g.s.	Colo.	12,655	1	13,921	Jan. '12	0.10
Iron Blossom, s.l.g.	Utah	1,000,000	0.10	1,770,000	Oct. '13	0.10
Iron Silver, s.l.g.	Colo.	500,000	20	4,850,000	Oct. '13	0.10
Jamison, g.	Cal.	390,000	10	378,300	Jan. '11	0.02
Jerry Johnson, g.	Colo.	2,500,000	0.10	175,000	Aug. '12	0.01
Kendall, g.	Mont.	500,000	5	1,475,000	Nov. '12	0.02
Kennedy, g.	Cal.	100,000	100	1,831,001	Apr. '10	0.03
King of Arizona, g.	Ariz.	200,000	1	396,000	Aug. '09	0.12
Klar Piquette, z.l.	Wis.	20,000	1	187,500	Apr. '13	0.50
Knob Hill, g.	Wash.	1,000,000	1	45,000	May '12	0.00½
Liberty Bell, g.	Colo.	130,551	5	1,452,338	Sept. '12	....
Little Bell, l.s.	Utah	300,000	1	75,000	Mar. '11	0.05
Little Florence, g.	Nev.	1,000,000	1	430,000	Jan. '08	0.03
Mammoth, g.s.c.	Utah	400,000	25	2,300,000	July '13	0.05
Mary McKinney, g.	Colo.	1,309,252	1	1,007,658	Oct. '13	0.02
May Day, g.s.l.	Utah	800,000	0.25	132,000	Feb. '13	0.03
Mexican, g.s.	Nev.	201,600	2.50	20,160	Aug. '11	0.10
Miami, c.	Ariz.	664,993	5	2,588,910	Nov. '13	0.50
Modoc, g.s.	Colo.	500,000	1	275,000	Dec. '11	0.01
Mohawk, c.	Mich.	100,000	25	3,175,000	Aug. '13	2.00
Monarch-Mad'a, g.s.l.	Colo.	1,000,000	1	40,000	May '11	0.01
Montana-Tonop., s.g.	Nev.	921,865	1	530,000	Dec. '12	0.10
Mountain, c.	Cal.	250,000	25	4,216,250	May '08	0.44
National, g.	Nev.	750,000	1	570,000	May '11	0.10
Nevada Con., c.	Nev.	1,999,524	5	14,727,271	Dec. '13	0.87½
New Century, z.l.	Mo.	330,000	1	237,600	Oct. '09	0.01
New Idria, q.	Cal.	100,000	5	1,730,000	Dec. '13	0.10
North Butte, c.	Mont.	410,000	15	11,275,000	Oct. '13	0.50
North Star, g.	Cal.	250,000	10	4,086,986	Dec. '13	0.20
Old Domin'n, M. & Sm.	Ariz.	162,000	25	3,361,000	Oct. '13	1.25
Ophir, s.g.	Nev.	201,600	3	2,068,360	Jan. '12	0.10
Opohongo, g.s.l.	Utah	898,978	0.25	80,907	Jan. '13	0.02
Oroville Dredging	Cal.	700,000	5	1,383,036	Dec. '09	0.12½
Osceola, c.	Mich.	96,150	25	11,891,225	Oct. '13	2.00
Parrot, c.	Mont.	229,850	10	7,290,227	Nov. '13	0.15
Pearl Con., g.	Wash.	1,909,711	0.05	181,422	Dec. '10	0.02
Pharmacist, g.	Colo.	1,500,000	1	87,500	Feb. '10	0.00½
Pioneer, g.	Alas.	5,000,000	1	2,041,526	Oct. '11	0.03
Pittsburgh-Idaho, l.	Iad.	803,000	1	216,810	Oct. '12	0.04
Pittsburgh Silver Peak, g	Nev.	2,790,000	1	659,600	Nov. '13	0.02
Portland, g.	Colo.	3,000,000	1	9,387,080	Dec. '13	0.02
Quilp	Wash.	1,500,000	1	67,500	Feb. '13	0.01
Quincy, c.	Mich.	110,000	25	20,952,500	Dec. '13	1.25
Republic, g.	Wash.	1,000,000	1	85,000	Dec. '10	0.01½
Rochester, l.z.	Mo.	4,900	100	188,396	Dec. '10	0.50
Round Mountain, g.	Nev.	866,426	1	363,365	Aug. '13	0.04

Mining Companies—United States—(*Continued*)

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt
Seven Troughs Coal., g.	Nev.	1,500,000	$ 1	$ 37,500	July '12	$0.02½
St. Joseph, l.	Mo.	1,000,000	10	9,053,357	Dec. '13	0.10
Shannon, c.	Ariz.	300,000	10	750,000	Jan. '13	0.50
Shattuck-Arizona, c.	Ariz.	350,000	10	1,575,000	Oct. '13	0.50
Silver King Coal, l.s.	Utah	1,250,000	5	2,346,585	Dec. '13	0.15
Sioux Con., s.l.g.	Utah	745,389	1	872,097	July '11	0.04
Skidoo, g.	Cal.	1,000,000	5	275,000	May '12	0.02½
Smuggler, l.s.z.	Colo.	1,000,000	1	2,235,000	Nov. '06	0.03
Snowstorm, c.g.	Ida.	1,500,000	1	1,192,103	Oct. '13	0.02
South Eureka, g.	Calif.	299,981	1	366,881	Apr. '12	0.07
Standard Con., g.s.	Cal.	178,394	10	5,274,767	Nov. '13	0.25
Stratton's Ind., g.	Colo.	1,000,000	0.60	425,250	May '13	0.06
Success, z.	Ida.	1,500,000	1	925,000	May '13	0.02
Superior & Pitts., c.	Ariz.	1,499,793	10	5,939,184	Dec. '13	0.38
Tamarack, c.	Mich.	60,000	25	9,420,000	July '07	4.00
Tennessee, c.	Tenn.	200,000	25	3,856,250	Dec. '13	0.75
Tomboy, g.s.	Colo.	300,000	4.85	3,332,245	Dec. '13	0.48
Tom Reed, g.	Ariz.	909,555	1	1,610,008	Dec. '13	0.06
Tonopah Belm't, s.g.	Nev.	1,500,000	1	5,243,000	Nov. '13	0.10
Tonopah Ext., g.s.	Nev.	943,433	1	424,529	Oct. '13	0.05
Tonopah of Nev., s.g.	Nev.	1,000,000	1	11,100,000	Sept. '13	0.25
Tri-Mountain, c.	Mich.	100,000	25	1,450,000	Dec. '13	2.00
Tuolumne, c.	Mont.	800,000	1	520,000	May '13	0.10
Uncle Sam, g.s.l.	Utah	500,000	1	495,000	Sept. '11	0.05
United Cop. Min., c.	Wash.	1,000,000	1	40,000	Nov. '12	0.01
United (Crip. Ck.) g.	Colo.	4,000,100	1	440,435	Jan. '10	0.04
United Globe, c.	Ariz.	23,000	10	1,529,500	Oct. '13	7.50
United Verde, c.	Ariz.	300,000	10	33,472,000	Dec. '13	0.75
Utah, s.l.	Utah	100,000	10	281,860	Dec. '10	0.02
Utah, c.	Utah	2,797,182	10	20,978,865	Sept. '13	0.75
Utah Con., c.	Utah	300,000	5	7,950,000	Nov. '13	0.50
Valley View, g.	Colo.	1,000,000	1	240,000	Dec. '10	0.04
Victoria, g.s.l.	Utah	250,000	1	207,500	Mar. '10	0.04
Vindicator Con., g.	Colo.	1,500,000	1	2,767,000	Oct. '13	0.03
Wasp No. 2, g.	S. D.	500,000	1	436,965	Oct. '13	0.01
Wellington Mines, g.	Colo.	10,000,000	1	300,000	July '13	0.00½
Wolverine, c.	Mich.	60,000	25	7,740,000	Apr. '13	5.00
Work, g.	Colo.	1,500,000	1	172,500	July '08	0.00½
Yak, s.l.	Colo.	1,000,000	1	1,927,655	July '13	0.02
Yankee Con., g.s.	Utah	1,000,000	1	143,500	Jan. '13	0.01
Yellow Aster, g.	Cal.	100,000	10	1,186,789	Dec. '13	0.05
Yellow Pine, l.z.s.	Nev.	1,000,000	1	343,008	Dec. '13	0.02
Yukon Gold, g.	Alas.	3,500,000	5	5,572 500	Dec. '13	0.07½

Iron, Industrial and Holding Companies

Amalgamated, c.	Mont.	1,538,87½	$100	$81,276,429	Nov. '13	$1.50
Am. Sm. & Ref., com.	U. S.	500,000	100	25,333,333	Dec. '13	1.00
Am. Sm. & Ref., pf.	U. S.	500,000	100	46,458,333	Dec. '13	1.75
Am. Smelters, pf. A.	U. S.	170,000	100	8,130,000	Oct. '13	1.50
Am. Smelters, pf. B.	U. S.	300,000	100	12,357,000	Oct. '13	1.25
Cambria Steel	Penn.	900,000	50	18,460,000	Nov. '13	0.62½
Greene Cananea	U. S.	2,471,314	25	2,913,020	Dec. '13	1.25
Guggenheim Expl.	U. S.	831,732	25	17,897,500	Oct. '13	0.62½
Inter'l Nickel, com.	U. S.	115,826	100	11,037,449	Dec. '13	3.00
Inter'l Nickel, pfd.	U. S.	89,126	100	7,690,046	Nov. '13	1.50
Inter'l Sm. & Ref.	U. S.	100,000	100	3,500,000	Dec. '13	2.00
National Lead, com.	N. Y.	206,554	100	7,796,224	Dec. '13	0.75
National Lead, pf.	N. Y.	243,676	100	27,560,940	Dec. '13	1.75
Old Dominion, c.	Ariz.	293,245	25	4,680,300	Oct. '13	1.25
Phelps, Dodge & Co.	U. S.	450,000	100	30,371,527	Dec. '13	5.00
U. S. Steel Corp., com.	U. S.	5,083,025	100	200,562,182	Dec. '13	1.25
U. S. Steel Corp., pf.	U. S.	3,602,811	100	364,269,107	Nov. '13	1.75
U. S. S., R. & M., com.	U.S.-Mex.	486,320	50	5,572,183	Oct. '13	0.75
U. S. S., R. & M., pf.	U.S.-Mex.	351,105	50	12,965,225	Oct. '13	0.87½

Canadian, Mexican and Central American Companies

Ajuchitlan, g.s.	Mex.	50,000	$ 5	$ 212,500	Oct. '12	$0.25
Amparo, g.s.	Mex.	2,000,000	1	1,240,884	Nov. '13	0.04
B. C. Copper	B. C.	591,709	5	615,198	Jan. '13	0.15
Beaver Con., s.	Ont.	1,996,490	1	409,879	Dec. '13	0.03
Buffalo, s.	Ont.	1,000,000	1	2,477,000	Nov. '13	0.07
Cobalt Townsite, s.	Ont.	1,000,000	1	700,000	Nov. '13	0.24
Coniagas, s.	Ont.	800,000	5	5,560,000	Nov. '13	0.70
Con. M. & S. Co. of Can	B. C.	58,052	100	1,246,237	Oct. '13	2.00
Crown Reserve, s.	Ont.	1,768,814	1	5,412,572	Nov. '13	0.02
Crow's Nest Pass C. Co.	B. C.	248,506	25	2,182,864	Mar. '11	0.25
Dominion Coal, com.	N. S.	150,000	100	5,550,000	Jan. '13	1.00
Dominion Coal, pf.	N. S.	50,000	100	4,915,000	Aug. '12	3.50
Dos Estrellas, g.s.	Mex.	300,000	0.50	9,885,000	Sept. '13	1.25
El Oro, g.s.	Mex.	1,147,500	4.85	8,947,261	July '13	0.24
Esperanza, s.g.	Mex.	455,000	4.85	11,830,455	July '13	0.36
Granby, s.l.c.	B.C.	148,496	100	5,087,915	Dec. '13	1.50
Greene Con., c.	Mex.	1,000,000	10	8,544,400	Nov. '13	0.50
Guanajuato D., pf., s.	Mex.	10,000	1000	274,356	Jan. '11	3.00
Hedley Gold	B. C.	120,000	10	1,233,520	Dec. '13	1.50
Hollinger, g.	Ont.	600,000	5	1,440,000	Dec. '13	0.30
Kerr Lake s.	Ont.	600,000	5	4,920,000	Dec. '13	0.25
La Rose Con., s.	Ont.	1,498,407	5	4,637,803	Oct. '13	0.25
Le Roi No. 2, g.	B. C.	120,000	24.30	1,472,580	Jan. '13	0.36
Lucky Tiger Com., g.	Mex.	715,337	10	2,054,472	Dec. '13	0.06
McK.-Dar. Sav. s.	Ont.	2,247,692	1	3,856,026	Nov. '13	0.10
Mines Co. of Am. (new)	Mex.	1,700,000	10	*1,215,000	July '13	0.12½
N. Y. & Hond. Ros.	C. A.	150,000	10	3,270,000	Dec. '13	0.30
Nipissing, s.	Ont.	1,200,000	5	10,890,000	Oct. '13	0.37½
Peñoles, s.l.g.	Mex.	80,000	25	6,361,688	June '13	1.25
Peregrina M. & M., pf.	Mex.	10,000	100	328,656	Sept. '10	3.50
Pinguico, pf., s.	Mex.	20,000	100	660,000	Apr. '12	3.00
Right of Way Mns†s.	Ont.	1,685,500	1	202,260	Dec. '11	0.02
Rio Plata, s.	Mex.	373,437	5	345,714	Feb. '13	0.05
San Rafael, g.s.	Mex.	2,400	25	1,441,180	Oct. '13	0.50
San Toy, g.s.	Mex.	6,000,000	1	540,000	July '13	0.01
Sopresa, g.s.	Mex.	19,200	20	3,979,240	Jan. '11	34.00
Stand'd Silver-Lead.	B. C.	2,000,000	1	1,075,000	Dec. '13	0.05
Timiskaming, s.	Ont.	2,500,000	1	1,534,155	Apr. '13	0.06
Tem. & Hud. Bay, s.	Ont.	7,761	1	1,870,401	Nov. '13	3.00
Trethewey, s.	Ont.	1,000,000	1	1,001,998	Dec. '13	0.10
Wettlaufer-Lorrain, s.	Ont.	1,416,590	1	637,465	Oct. '13	0.05

*Previous to reorganization, $5,258,881.
†Previous to January, 1910, $324,644.

Assessments

Company	Delinq.	Sale	Amt.
Bullion Beck & Champion, Utah	Dec. 1	Jan. 26	$0.20
Carbonate Center, Ida., post'd		Jan. 27	0.001
Cedar-Talisman, Utah			0.005
Central Eureka, Calif	Jan. 16	Feb. 17	0.05
Century, Utah	Jan. 2	Feb. 2	0.01
Clear Grit, Ida, post'd		Feb. 9	0.0025
Cons. Imperial, Nev	Jan. 7	Jan. 29	0.01
Cons Virginia, Nev	Jan. 13	Feb. 3	0.10
Empire, Ida., postponed		Feb. 2	0.005
Greenhorn, Utah	Dec. 24	Jan. 31	0.005
Montello, Utah	Jan. 11	Jan. 30	0.005
North Bunker Hill, Ida	Jan. 8	Feb. 7	0.002
North Franklin, Ida., postp'd		Jan. 29	0.005
North Scranton, Utah	Dec. 26	Jan. 26	0.002
Pioche Metals, Nev	Jan. 9	Feb. 2	0.0025
Polar Star, Utah	Jan. 17	Feb. 2	0.0017
Providence Gold, Utah	Dec. 27	Jan. 31	0.01
Raymond-Illinois, Utah	Jan. 15	Jan. 31	0.005
Ruby Mountain, Nev	Jan. 17	Feb. 2	0.0017
Sandstorm-Kendall, Nev	Dec. 29	Feb. 2	0.02
Silver Eagle, Ida	Jan. 14	Jan. 26	0.0015
South Iron Blossom, Utah			0.0012
Tarbox, Ida	Dec. 29	Jan. 27	0.002
United Tintic, Utah	Jan. 20	Feb. 9	0.0025
Utah-Arizona, Ariz	Jan. 17	Feb. 3	0.005
Utah-Yerington, Nev	Jan. 10	Feb. 7	0.0005
West-Yerington, Nev	Jan. 10	Feb. 7	.00075

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.260	62.938	24.865	25.887	28.983
February	52.222	59.043	61.642	24.081	27.190	28.357
March	52.745	58.375	57.870	24.324	26.875	26.669
April	53.325	59.207	59.490	24.595	27.284	27.416
May	53.308	60.880	60.361	24.583	28.038	27.825
June	53.043	61.290	58.990	24.486	28.215	27.199
July	52.630	60.654	58.721	24.286	27.919	27.074
August	52.171	61.606	59.293	24.082	28.375	27.335
September	52.440	63.078	60.640	24.209	29.088	27.986
October	53.340	63.471	60.793	24.594	29.299	28.083
November	55.719	62.792	58.995	25.649	29.012	27.263
December	54.905	63.365	57.760	25.349	29.320	26.720
Year	53.304	60.835	59.791	24.592	28.042	27.576

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York				London Standard	
	Electrolytic		Lake			
	1912	1913	1912	1913	1912	1913
January	14.094	16.488	14.337	16.767	62.760	71.741
February	14.084	14.971	14.329	15.253	62.893	65.519
March	14.698	14.713	14.868	14.930	65.884	65.329
April	15.741	15.291	15.930	15.565	70.294	68.111
May	16.031	15.436	16.245	15.738	72.352	68.807
June	17.234	14.672	17.443	14.871	78.259	67.140
July	17.190	14.190	17.353	14.563	76.636	64.166
August	17.498	15.400	17.644	15.904	78.670	69.200
September	17.508	16.328	17.698	16.799	78.762	73.125
October	17.314	16.337	17.661	16.913	76.389	73.383
November	17.326	15.182	17.617	16.022	76.890	68.275
December	17.376	14.224	17.600	14.904	75.516	65.223
Year	16.341	15.269	16.560	15.686	72.942	68.335

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	50.298	191.519	238.273
February	42.962	48.766	195.036	220.140
March	42.577	46.832	192.619	213.615
April	43.923	49.115	200.513	224.159
May	46.063	49.038	208.830	224.143
June	45.815	44.820	205.863	207.208
July	44.519	40.260	202.446	183.511
August	45.857	41.582	208.351	188.731
September	49.135	42.410	223.762	193.074
October	50.077	40.462	228.353	184.837
November	49.891	39.810	227.619	180.869
December	49.815	37.635	226.875	171.786
Av. year	46.096	44.252	209.322	206.279

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4.321	4.327	4.171	15.597	17.114
February	4.026	4.325	3.946	4.175	15.738	16.550
March	4.073	4.327	4.046	4.177	15.997	15.977
April	4.200	4.381	4.118	4.242	16.331	17.597
May	4.194	4.342	4.072	4.226	16.509	18.923
June	4.392	4.325	4.321	4.190	17.588	20.226
July	4.720	4.353	4.603	4.223	18.544	20.038
August	4.569	4.624	4.452	4.550	19.655	20.406
September	5.048	4.698	4.924	4.579	22.292	20.648
October	5.071	4.402	4.894	4.253	20.630	20.302
November	4.615	4.293	4.463	4.146	18.193	19.334
December	4.303	4.047	4.152	3.929	18.069	17.798
Year	4.471	4.370	4.360	4.238	17.929	18.743

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	6.239	6.349	6.089	26.661	25.338
March	6.626	6.078	6.476	5.926	26.048	24.605
April	6.633	5.641	6.483	5.491	25.644	25.313
May	6.679	5.406	6.529	5.256	25.790	24.583
June	6.877	5.124	6.727	4.974	25.763	22.143
July	7.116	5.278	6.966	5.128	26.174	20.592
August	7.028	5.658	6.878	5.508	26.443	20.706
September	7.454	5.694	7.313	5.544	27.048	21.148
October	7.426	5.340	7.276	5.188	27.543	20.614
November	7.371	5.229	7.221	5.083	26.804	20.581
December	7.162	5.156	7.081	5.004	26.494	21.214
Year	6.943	5.648	6.799	5.504	26.421	22.746

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	$15.12	$18.15	$13.32	$17.35	$14.00	$18.59
February	15.03	18.15	13.28	17.22	14.01	18.13
March	14.95	18.15	13.66	16.96	14.10	17.53
April	15.13	17.90	13.90	16.71	14.15	16.40
May	15.14	17.68	13.90	15.80	14.12	15.40
June	15.15	17.14	14.11	15.40	14.22	15.10
July	15.15	16.31	14.38	15.13	14.38	14.74
August	15.43	16.63	14.90	15.00	14.85	14.88
September	16.86	16.65	16.03	15.04	15.63	14.93
October	17.90	16.60	17.18	14.61	17.22	14.80
November	18.07	16.03	17.09	13.91	18.00	14.40
December	18.15	15.71	17.45	13.71	18.73	14.28
Year	$16.01	$17.09	$14.93	$15.57	$15.28	$15.77

STOCK QUOTATIONS

COLO. SPRINGS Jan. 20

Name of Comp.	Bid.
Acacia	.02¼
Cripple Cr'k Con.	.009
C. K. & N.	.06
Doctor Jack Pot	.06¼
Elkton Con.	.50
El Paso	2.05
Findlay	.02
Gold Dollar	.06½
Gold Sovereign	.01¼
Golden Cycle	1.00
Isabella	.09
Jack Pot	.05¼
Jennie Sample	.05
Jerry Johnson	.05
Lexington	.003
Old Gold	.01
Mary McKinney	.56
Pharmacist	.01
Portland	.99
Vindicator	.79

SALT LAKE Jan. 20

Name of Comp.	Bid.
Beck Tunnel	.05½
Black Jack	.06½
Cedar Talisman	.00½
Colorado Mining	.11½
Crown Point	.01
Daly-Judge	5.10
Gold Chain	.15
Grand Central	.50
Iron Blossom	1.07½
Little Bell	.10
Lower Mammoth	.01
Mason Valley	3.75
May Day	.05
Nevada Hills	.39
New York	‡.00½
Prince Con.	.18
Silver King Coal'n	3.37½
Sioux Con.	.02
Uncle Sam	.05
Yankee	.03

TORONTO Jan. 20

Name of Comp.	Bid.	Name of Comp.	Bid.
Bailey	0.05½	Foley O'Brien	0.18
Coniagas	7.00	Hollinger	16.87½
Right of Way	0.04½	Imperial	*0.01½
T. & Hudson Bay	70.00	Jupiter	0.08
Timiskaming	0.12½	Pearl Lake	0.10
Wettlaufer-Lor	0.07	Porcu. Gold	0.10½
Big Dome	15.00	Preston E. D.	0.01½
Crown Chartered	*0.00½	Rea	0.10
Doble	*0.10	Swastika	0.03½
Dome Exten	0.07	West Dome	0.06

SAN FRANCISCO Jan. 20

Name of Comp.	Bid	Name of Comp.	Bid
Comstock Stocks		Misc. Nev. & Cal.	
Alta	‡.07	Belmont	7.65
Belcher	‡.62	Jim Butler	.90
Best & Belcher	.05	MacNamara	.10
Caledonia	1.35	Midway	.38
Challenge Con.	.12	Mont.-Tonopah	1.10
Chollar	.02	North Star	.39
Confidence	.34	West End Con.	1.32½
Con. Virginia	.20	Atlanta	.16
Crown Point	.36	Booth	.02
Gould & Curry	.02	C.O.D. Con	.03
Hale & Norcross	.07	Comb. Frac	.06
Mexican	1.15	Jumbo Extension	.17
Occidental	.70	Pitts.-Silver Peak	.36
Ophir	.20	Round Mountain	.44
Overman	.30	Sandstorm Kendall	.10
Potosi	.01	Silver Pick	.05
Savage	.09	Argonaut	‡2.50
Sierra Nevada	.08	Bunker Hill	‡1.50
Union Con.	.10	Central Eureka	.30
Yellow Jacket	.30	So. Eureka	2.00

N. Y. EXCH. Jan. 20

Name of Comp.	Clg.
Amalgamated	75½
Am. Agri. Chem.	52½
Am.Sm.&Ref.,com.	68½
Am. Sm. & Ref., pf.	101½
Am. Sm. Sec., pf. B	82
Anaconda	35½
Batopilas Min.	¼
Bethlehem Steel,pf.	75½
Chino	40
Federal M. & S., pf.	40
GreatNor.,ore,,ctf.	37½
Guggen. Exp.	46
Homestake	114
Inspiration Con.	15½
Miami Copper	23½
Nat'l Lead, com.	47½
National Lead, pf.	104
Nev. Consol.	15¾
Phelps Dodge	183
Pittsburg Coal, pf.	87½
Quicksilver, pf.	2½
Ray Con.	18¼
Republic I&S,com.	24
Republic I&S, pf.	86½
SlossSheffi'd,com.	32½
Sloss Sheffield, pf.	90
Tennessee Copper	34½
Utah Copper	53
U. S. Steel, com.	63½
U. S. Steel, pf.	109
Va.Car.Chem.,pf.	101

BOSTON EXCH Jan. 20

Name of Comp.	Clg.
Adventure	1½
Ahmeek	‡289
Alaska Gold M.	22½
Algomah	1½
Allouez	37½
Am. Zinc	‡20
Ariz. Com., ctfs.	4½
Bonanza	.60
Boston & Corbin	‡.50
Butte & Balak	4
Calumet & Ariz.	65½
Calumet & Hecla	425
Centennial	16½
Cliff	‡2
Copper Range	39½
Daly West	‡2½
East Butte	12½
Franklin	‡3½
Granby	81
Hancock	17½
Hedley Gold	‡29
Helvetia	.35
Indiana	5½
Island Cr'k, com	47½
Island Cr'k, pfd.	85
Isle Royale	21½
Keweenaw	2½
Lake	10
La Salle	4½
Mass.	3 1/16
Michigan	1
Mohawk	45½
New Arcadian	3½
New Idria Quick	‡3½
North Butte	28½
North Lake	2
Ojibway	‡.75
Old Dominion	52
Osceola	78
Quincy	‡60
Shannon	6½
Shattuck-Ariz.	28½
Superior	28
Superior & Bost.	2½
Tamarack	31
Trinity	4½
Tuolumne	‡.60
U. S. Smelting	41½
U. S. Smelt'g, pf.	47½
Utah Apex	1½
Utah Con.	10½
Victoria	1½
Winona	3
Wolverine	46½
Wyandot	‡.75

N. Y. CURB Jan. 20

Name of Comp.	Clg.
Ariz. Belmont	.03½
Barnes King	1½
Beaver Con.	.30
Boston Montana	5½
Braden Copper	7½
B. C. Copper	2½
Buffalo Mines	2 1/16
Can. G. & S.	.07
Caribou	.68
Con. Ariz. Sm.	3/16
Coppermines Cons.	2½
Davis-Daly	1 15/16
Diam'field-Daisy	.04
Ely Con	.04½
Florence	.39
Gold Hill Con.	.28
Goldfield Con.	1 9/16
Greene Cananea	36½
Greenwater	.06
Internat. S. & R.	‡115
Kerr Lake	5
La Rose	1 13/16
McKinley-Dar-Sa.	1½
Min. Co. of A. new	2½
New Utah Bingham	‡.41
Nipissing Mines	8
Ohio Copper	1/16
Puebla S. & R.	2½
South Utah M&S.	.25
Stand'd Oil of N.J.	413
Stand'd Silver Lead	1 9/16
Stewart	1½
Tonopah	7½
Tonopah Ex.	1½
Tonopah Merger	.54
Tri-Bullion	7/32
Tularosa	1/8
Union Mines	‡.08
United Cop., pfd.	‡3
Yukon Gold	2 1/16

BOSTON CURB Jan. 20

Name of Comp.	Bid
Bingham Mines	4½
Boston Ely	.50
Butte&Lon'nDev.	.30
Cactus	.01½
Calaveras	1½
Chief Cons.	1 1/16
Corbin	1½
Cortez	.22
Crown Reserve	1 1/16
Eagle & Blue Bell	.95
First Nat. Cop.	3 1/16
Houghton Copper	2½
Majestic	.24
Mexican Metals	21
Moneta Porc.	‡.01
Nevada-Douglas	1½
New Baltic	1½
Oneco	1
Raven Copper	.12
Rhode Island Coal	‡.01
Smokey Dev.	.75
So. Lake	5
S. W. Miami	1
Tonopah Victor	.20
Trethewey	.25
United Verde Ext.	.47

LONDON Jan. 10

Name of Comp.	Clg.
Camp Bird	£0 11s 0d
El Oro	0 13 6
Esperanza	0 18 1½
Mexico Mines	5 0 0
Oroville	0 14 9
Santa Gert'dis.	0 16 3
Stratton's	0 0 6
Tomboy	1 5 0

‡Last Quotation.